

PROJECT MANUAL

FOR THE CONSTRUCTION OF

SR-82

BLDG 1 – 7691 Native Lane
BLDG 2 – 7681 Native Lane
BLDG 3 – 7671 Native Lane
BLDG 4 – 7661 Native Lane
BLDG 5 – 7651 Native Lane
BLDG 6 – 7701 Native Lane
BLDG 7 – 7676 Native Lane
BLDG 8 – 7674 Native Lane
BLDG 9 – 7668 Native Lane
BLDG 10 – 7650 Native Lane
BLDG 11 – 7692 Native Lane
BLDG 12 – 7665 Native Lane
Compactor enclosure – 7678 Native Lane
Mail Kiosk

Fort Myers, FL 33905

Project Number: 220035.00

January 6th, 2023

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SECTION 000107-1 - SEALS PAGES

1.1 DESIGN PROFESSIONALS OF RECORD

A. ARCHITECT OF RECORD

Architect of Record
Baker Barrios Architects
189 S Orange Ave
Suite 1700
Orlando, FL 32801

I hereby specify that the specification sections intended to be authenticated by my seal are those in Divisions 02-11 and 32 except where indicated as prepared by other design professionals of record.



Architect of Record

06 Jan 2023

Date

SECTION 000107-2 – SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. STRUCTURAL ENGINEER OF RECORD

CORDELL SEILER VAN NOSTRAND
SNELL ENGINEERING CONSULTANTS
1517 STATE STREET, SUITE 202
SARASOTA, FL 34236

I hereby specify that the specification sections intended to be authenticated by my seal are limited to:

- 03 30 00 – CAST-IN-PLACE CONCRETE
- 04 20 00 - UNIT MASONRY
- 06 10 00 – ROUGH CARPENTRY
- 06 16 00 – SHEATHING
- 06 17 53 – SHOP-FABRICATED WOOD TRUSSES

This item has been digitally signed and sealed by Cordell S. Van Nostrand on 01/06/23 using a Digital Signature.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Snell Engineering Consultants

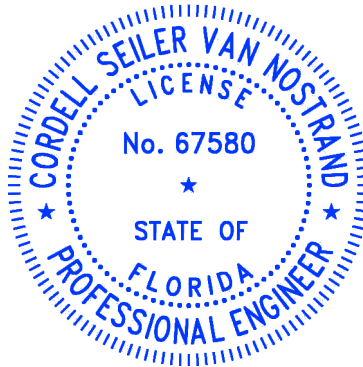


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1.1 OWNER INFORMATION

A. Owner: Milhaus Development.

1. Address: 460 Virginia Avenue, Indianapolis, Indiana 46203.
2. Tel. No.: 317-226-9500.

1.2 DESIGN PROFESSIONALS OF RECORD

A. Architect: Baker Barrios Architects.

1. Address: 189 S. Orange Ave., Suite 1700, Orlando, Florida 32801.
2. Tel. No.: 407-926-3000.

B. Civil Engineer: Kimley-Horn.

1. Address: 1412 Jackson Street, STE 2, Fort Myers, Florida 33901.
2. Tel. No.: 239-984-6524.
3. Contact: Sina Ebrahimi.

C. Landscape Architect:

1. Address: 1412 Jackson Street, STE 2, Fort Myers, Florida 33901.
2. Tel. No.: 239-984-6524.
3. Contact: Sina Ebrahimi.

D. Structural Engineer: Snell Engineering.

1. Address: 1517 State Street, Suite 202, Sarasota, Florida 34236.
2. Tel. No.: 941-954-0681.

E. MEPFP Engineer: Quest Design Group.

1. Address: 1100 Jorie Blvd., Suite 224, Oak Brook, Illinois 60523.
2. Tel. No.: 630-854-1215.
3. Contact: Michael Janis.

END OF SECTION 000115

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Work restrictions.
 - 5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

- A. Project Identification: Milhaus SR-82.
 - 1. Project Location: Fort Myers, Florida.
- B. Owner: Milhaus Development, 460 Virginia Avenue, Indianapolis, Indiana 46203. Tel. No. (317) 226-9500.
- C. Architect: Baker Barrios Architects, Inc. 189 S. Orange Ave., Suite 1700, Orlando, Florida 32801. Tel. No. (407) 926-3000.
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
 - 1. Civil Engineer: Kimley-Horn, 1412 Jackson Street, Suite 2, Fort Myers, Florida 33901. Tel. No. (239) 984-6524. Contact: Sina Ebrahimi.
 - 2. Structural Engineer: Snell Engineering, 1517 State Street, Suite 202, Sarasota, Florida 34236. Tel. No.: (941) 954-0681.
 - 3. MEPFP Engineer: Quest Design Group, 1100 Jorie Blvd., Suite 224, Oak Brook, Illinois 60523. Tel. No. (630) 854-1215. Contact: Michael Janis.
 - 4. Landscape Architect: Kimley-Horn, 1412 Jackson Street, Suite 2, Fort Myers, Florida 33901. Tel. No. (239) 984-6524. Contact: Sina Ebrahimi.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents.
- B. Type of Contract: Project will be constructed under a single prime contract.
- C. Quality Standard: Comply with applicable requirements of Milhaus Development's "Milhaus Architectural Building Standards Manual."

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- C. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- D. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Owner's representative.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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 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 13.1, A., or other form acceptable to Architect.
 - 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 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. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. 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: Not allowed.

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 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."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect 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 Architect 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 Architect.
- 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 acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. 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 012900 - PAYMENT 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 necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.

- d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- 1.7 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

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 documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 3. Total Float Report: List of all activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at weekly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
1. Review software limitations and content and format for reports.
 2. Verify availability of qualified personnel needed to develop and update schedule.
 3. Discuss constraints, including phasing, work stages, interim milestones, and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review submittal requirements and procedures.
 7. Review time required for review of submittals and resubmittals.
 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 9. Review time required for Project closeout and Owner startup procedures.
 10. Review and finalize list of construction activities to be included in schedule.
 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 3. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Uninterruptible services.
 - b. Partial occupancy before Substantial Completion.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.

- c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Use Microsoft Project or Primavera, unless otherwise directed by Owner, for current Windows operating system.

2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

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. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.
5. Preconstruction video recordings.
6. Periodic construction video recordings.

- B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

- B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos on by uploading to web-based Project management software. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.

- d. Name of Contractor.
- e. Date photograph was taken.
- f. Description of location, vantage point, and direction.
- g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within seven days of recording.

- 1. Submit video recordings by uploading to web-based Project management web-based Project management software site:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time from camera.
- E. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Flag construction limits before taking construction photographs.
 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
1. Underground utilities.
 2. Underslab services.
 3. Piping.
 4. Electrical conduit.
 5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take 20 photographs weekly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- G. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.

- e. Extra record photographs at time of final acceptance.
- f. Owner's request for special publicity photographs.

1.7 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
 - 1. Confirm date and time at beginning and end of recording.
 - 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- C. Periodic Construction Video Recordings: Record video recording monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
- 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list 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 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 final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.

- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- E. Submittals for Web-Based Newforma Project Software: Prepare submittals as PDF files, or other format indicated by Project Newforma software website.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- 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 submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. 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.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable 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 that show 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 Shop Drawings, and before or concurrent with Samples.
- B. 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.
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.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 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 Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. 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.
- E. 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.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.

2. 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.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. 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.

H. Test and Research Reports:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 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 insufficient 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 file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project software. Include 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.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY 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 quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner as indicated elsewhere in the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as plastering, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

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

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service overhead unless otherwise indicated.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install lighting for Project identification sign.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line for each field office.
1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - b. Provide one telephone line for Owner's use.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Core i5 or i7.
 2. Memory: 16 gigabyte.

3. Disk Storage: 1-terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:
 - a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader DC.
 - c. WinZip 10.0 or higher.
9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 Mbps upload and 15 -Mbps download speeds at each computer.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum 2 terrabytes, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas as specified elsewhere and indicated on Drawings.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

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

- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 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 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will 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 012500 "Substitution Procedures" for proposal of product.

- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. 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.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.

- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. 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.
- D. Certified Surveys: Submit two copies signed by land surveyor.
- 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.

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.
 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. 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.
- 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 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 local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 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 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 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.

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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect 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. Temporary Support: Provide temporary support of work to be cut.
- C. 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.
- D. 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.
- E. 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.
- F. 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 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 015000 "Temporary Facilities and Controls."
- 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.

3.8 STARTING AND ADJUSTING

- A. **Start equipment and operating components** to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. **Adjust equipment for proper operation.** Adjust operating components for proper operation without binding.
- C. **Test each piece of equipment to verify proper operation.** Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. **Manufacturer's Field Service:** Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for progress cleaning of Project site.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 017900 "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.

- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "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 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 Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. 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.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean areas as required, including walkways, to provide safe access to building.

- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

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

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect 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 will return copy with comments.
1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 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 Architect.
 - 7. Name and contact information for Commissioning Authority.
 - 8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 9. 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.
 8. Chemical release or spill.
- 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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. 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.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. 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.
- D. 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.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "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 one set of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

- E. Reports: Submit written report indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. 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.
 - 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.

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

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - 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.
 - 3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date of video recording.
 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 4. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.

1.6 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. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. 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.

8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

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 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- C. 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 with at least seven days' advance notice.
- D. 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.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Submit field or laboratory test records used to document that proposed mixture will achieve the required average compressive strength and other specified requirements in section 2.12 for

each class of concrete. Field test records for concrete strength test records must be from concrete supplied from the same production facilities proposed for Work. Test data shall be from concrete mixtures containing similar materials proposed for Work. Strength test records for establishing a standard deviation for each class of concrete or for documenting the required average strength for Work shall not be greater than 12 months old and shall be collected over a period not less than 60 days.

- B. Product Data: For each type of product indicated.
- C. Submit properties of mixtures for each class of concrete including:
 - 1. Mixture Identification by class
 - 2. Specified compressive strength, f'_c , that is applicable for the class
 - 3. Specified exposure class in Section 2.12
 - 4. Documentation of strength test records of similar class of concrete used to establish standard deviation in accordance with ACI 318, when test records exist
 - 5. Required average compressive strength, f'_{cr} , for each class of concrete
 - 6. Documentation of f'_{cr} of proposed mixture(s)
 - 7. Intended placement method
 - 8. Slump or slump flow
 - 9. Air content
 - 10. Density
 - 11. W/C Ratio
 - 12. Documentation supporting other specified requirements of concrete mixtures
 - 13. Nominal maximum aggregate size or Size number
 - 14. Type and information about the ingredient materials proposed for use including:
 - a. Cementitious Materials
 - b. Aggregates
 - c. Admixtures
 - d. Water
 - e. Fibers, color pigments, and other additions
- D. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- E. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Concrete shall be supplied from concrete plants with current certification under the NRMCA Certification of Ready Mixed Concrete Production Facilities, certification or approval by a state or highway agency or equivalent. Criteria of equivalent certification shall be included in the submittal.
2. Quality Control personnel with responsibility for concrete mixtures certified as an NRMCA Concrete Technologist Level 2, or equivalent. Criteria of equivalent certification shall be included in the submittal.
3. When requested, the manufacturer shall furnish a Quality Plan

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- E. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Galvanized-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

- B. Zinc Repair Material: ASTM A 780/A 780M.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials: Use materials meeting the following requirements:
 - 1. Hydraulic/Portland Cement: ASTM C150, ASTM C1157 or ASTM C595
 - 2. Fly Ash or Natural Pozzolan: ASTM C618
 - 3. Slag Cement: ASTM C989
 - 4. Silica Fume: ASTM C1240
- C. Normal-weight Aggregate: ASTM C33
 - 1. Nominal maximum size of coarse aggregate: <indicate the size as per design requirements for each class of concrete>
 - 2. Alkali Silica Reactivity: Aggregate shall be considered non-reactive with a documented satisfactory service record for a minimum ten year period used in concrete with similar cementitious materials or with an alkali (Na₂O eq.) content in concrete equal or higher than that in the proposed mixture. In the absence of service record the aggregate shall be tested and will be considered non-reactive if it passes one of the following two requirements – ASTM C1260 14-day expansion less than or equal to 0.10% or ASTM C1293 1-year expansion less than or equal to 0.040%. For aggregate that do not meet these criteria, mitigation measures shall apply in accordance with Section 2.12
- D. Lightweight Aggregate: ASTM C 330/C 330M, 1/2-inch nominal maximum aggregate size.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

G. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products:

- a. Boral Material Technologies, Inc.; Boral BCN.
- b. Euclid Chemical Company (The); Eucon CIA.
- c. Grace Construction Products, W. R. Grace & Co.; DCI.
- d. Master Builders, Inc.; Rheocrete CNI.
- e. Sika Corporation; Sika CNI.

H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:

- a. Axim Concrete Technologies; Catexol 1000CI.
- b. Boral Material Technologies, Inc.; Boral BCN2.
- c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
- d. Master Builders, Inc.; Rheocrete 222+.
- e. Sika Corporation; FerroGard-901.

I. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers:

- a. Bayer Corporation.
- b. ChemMasters.
- c. Conspec Marketing & Manufacturing Co., Inc.; a Dayton Superior Company.
- d. Davis Colors.
- e. Elementis Pigments, Inc.
- f. Hoover Color Corporation.
- g. Lambert Corporation.
- h. Scofield, L. M. Company.
- i. Solomon Colors.

2. Color: As selected by Architect from manufacturer's full range.

3. Application:

J. Water: ASTM C 94/C 94M and potable.

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

B. Synthetic Micro-Fiber: Fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

- C. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches long.

2.7 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
 - 1. Product: ADCOR ES by W. R. Grace.

2.8 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products:
 - a. Raven Industries Inc.; Vapor Block 15.
 - b. Stego Industries, LLC; Stego Wrap, 15 mils.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation-Construction Systems.
 - b. ChemMasters, Inc.
 - c. Dayton Superior.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. L&M Construction Chemicals, Inc.
 - f. Sika Corporation.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Product: L&M Construction Chemicals, Inc.; Dress & Seal WB30.
 - 2. Application: Use at floor slabs in Assisted Living and Memory Care building.

- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products:
 - a. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - b. L&M Construction Chemicals, Inc.; Lumiseal WB.
 - c. Meadows, W. R., Inc.; Vocomp-30.
 2. Application: Use at all floor slabs unless noted otherwise.

2.10 PENETRATING SEALER

- A. Penetrating, water and chloride repellent sealer for concrete.
- B. Basis of Design: Provide one of the following:
1. Euclid Chemical Company; Euco-Guard 100.
 2. Sika; Sikagard-701W.
- C. Application: Apply to parking level concrete slabs.

2.11 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
1. Colors: White and Yellow.
- E. Thermoplastic Wheel Stops: Traffic Safety Store; 6-foot commercial parking block. TrafficSafetyStore.com
1. Material: High density polyethylene.
 2. Size: 70-1/2 inch long by 5-3/4 inch wide by 4 inch tall.
 3. Color: Yellow.
 4. Mounting: Provide three concrete bolts at each wheel stop.
- F. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- G. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Design mixtures shall meet the specified strength requirements listed on the documents
- B. Contractor is responsible for preparation of design mixtures for each class of concrete used in construction.
- C. Alkali silica reactivity – For structural concrete members that will be moist in service and when it is determined as per Section 2.2B that the aggregate source used needs to include mitigative measures, submit documentation demonstrating that the proposed cementitious materials used with the aggregates by ASTM C1567 tests with an expansion after 14 days of exposure less than or equal to 0.1%.
- D. For members where control of curling or reduction in the potential for cracking is required and as designated in Contract documents, submit data on the length change characteristics of the concrete mixture tested in accordance with ASTM C157. Perform ASTM C157 tests and submit data showing length change not exceeding 0.05% after 7 days of moist curing followed by 28 days of air drying.
- E. The installer and manufacturer shall coordinate to establish properties of the fresh concrete to facilitate placement and finishing with reduced potential for segregation and bleeding. Factors shall include but are not limited to slump or slump flow, setting time, method of placement, rate of placement, hot and cold weather placement, curing, and concrete temperature. Selection of fresh concrete properties shall be notified to the Engineer of Record in the submittal.
- F. Contractor shall indicate reportable changes in sources of materials and quantities when such changes are necessary to ensure constructability, performance of concrete and compliance with the specification requirements. The contractor is permitted to make minor adjustments less than the reportable deviations noted in the original submittal to concrete mixtures to ensure uniformity of concrete without a re-submittal for review or approval.
- G. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- H. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.50, unless noted otherwise.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.50, unless noted otherwise.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.50, unless noted otherwise.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

D. Suspended Slabs: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.45, unless noted otherwise.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

E. Concrete Toppings: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.50, unless noted otherwise.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

F. Building Frame Members: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.45, unless noted otherwise.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

G. Building Walls: Normal-weight concrete.

1. Minimum Compressive Strength: As Indicated at 28 days.
2. Maximum W/C Ratio: 0.45, unless noted otherwise.
3. Minimum Cementitious Materials Content: 470 lb/cu. yd..
4. Slump Limit: 5 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd.

2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

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

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.17 TOPPING MIXING

- A. Bonding Slurry: Mix portland cement with water to a thick paint consistency.

- B. Bonding Slurry: Mix 1 part portland cement and 2 parts sand with water and an acrylic-bonding agent according to manufacturer's written instructions to a thick paint consistency.
- C. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
2. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.
3. **Vapor Barrier shall wrap up face of foundation wall to top of concrete slab on grade.**
4. **Vapor Barrier shall extend down foundation wall to top of footing.**
5. **Lap vapor barrier down face of footing wall to top of concrete footing. Seal vapor barrier to footing with manufacturer's mastic.**
6. Overlap joints 6 inches and seal with manufacturer's tape.
7. Seal all penetrations (including pipes) per manufacturer's instructions with manufacturer's Tape and Mastic.
8. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
9. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.
10. Vapor Barrier installation shall be observed by the Architect prior to placement of the concrete.
11. **Overlap new vapor retarder over existing vapor retarder where existing concrete slabs are cut. Seal vapor retarders together by overlapping 6 inches and taping the intersection of the two vapor retarders.**

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780/A 780M. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls **as indicated**. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints (Exposed Joints): Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints (Concealed Joints): Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view or to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
 3. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Minimum Compressive Strength: 4000 psi at 28 days.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least **[one] [six]** month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 EXAMINATION FOR FLOOR TOPPING

- A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.
- B. Verify that base concrete slabs comply with scratch finish requirements specified in Division 03 Section "Cast-in-Place Concrete."
- C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D 4263.
- D. Proceed with application only after unsatisfactory conditions have been corrected.

3.16 PREPARATION FOR FLOOR TOPPING

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch
 1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
 2. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
 3. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch and fill with semirigid joint filler.
 4. To both sides of joint edges and at perimeter of existing base slab.
- B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface, unless otherwise indicated.
 2. Terminate full-width, joint-filler strips 1/2 inch below topping surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.17 FLOOR TOPPING APPLICATION

- A. Start floor topping application in presence of manufacturer's technical representative.
- B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Division 03 Section "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.
- C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch, without puddling. Place floor topping while slurry is still tacky.

- D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch, without puddling. Place floor topping while adhesive is still tacky.
- E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
 - 1. Screed surface with a straightedge and strike off to correct elevations.
 - 2. Slope surfaces uniformly where indicated.
 - 3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- F. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
 - 1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
 - a. Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and measure within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface.
 - b. Finish and measure surface so gap at any point between surface and an unlevelled freestanding 10-foot- long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch.
- G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.
 - 1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
- H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
 - 1. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
 - 2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
 - 3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch deep.

3.18 PROTECTING AND CURING FLOOR TOPPING

- A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.

- B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.
- C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with water, continuous water-fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.19 JOINT FILLING FLOOR TOPPING

- A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.20 REPAIRS FOR FLOOR TOPPING

- A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.21 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes

- and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.22 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Concrete Strength Tests on Concrete:
 - a. Strength test results at the designated age shall be the average of two 6 inch diameter \times 12 inch or three 4 inch diameter \times 8 inch specimens.
 - b. Samples for concrete compressive strength tests of each class of concrete placed each day shall be taken not less than once per day, nor less than once for each 50 yd^3 of concrete, nor less than once for each 5000 ft^2 surface area for slabs or walls. If the total volume of concrete for a class is such that frequency of testing required is less than five tests, then samples shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
 - c. Acceptance of concrete shall be based on strength test results of standard cured cylinders in accordance with ASTM C31 and tested at 28 days in accordance with ASTM C39.
 - d. When strength cylinders are made, tests of slump, air content, temperature and density shall be made and recorded with the strength test results.
 - e. Strength of each concrete class shall be deemed satisfactory when both of the following criteria are met:
 - 1) The average of three consecutive compressive-strength tests equals or exceeds specified compressive strength
 - 2) Any individual compressive-strength test result does not fall below specified compressive strength, $f'c$
 - a) by more than 500 psi when $f'c \leq 5000$ psi
 - b) by more than $0.1f'c$ when $f'c > 5000$ psi
 - f. When compressive strength tests fail to meet the provisions of (d), follow procedure in ACI 318. Investigation of low-strength test results.
 - g. When it is deemed necessary to evaluate the adequacy of concrete strength, at least 3 cores shall be obtained from the portion of the structure represented by the low strength tests. Cores shall be removed and conditioned in accordance with ASTM C42. The strength of cores shall comply with the following:

- 1) Average strength of 3 cores $\geq 0.85f'_c$
 - 2) Individual core strength $\geq 0.75f'_c$
- h. Test one set of two field-cured specimens at 7 days, one set of two specimens at 28 days and one set of two specimens at 56 days.
- 1) Provide one additional set of two field cured specimens for an additional test where $f'_c > 6000$ psi
- i. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
2. Air Content: ASTM C231. Test when concrete is sampled for strength tests. ASTM C173 for structural lightweight concrete or when local practice dictates due to characteristics of aggregates used.
- a. Air content tests shall be performed on concrete at least at the same frequency as compressive strength testing.
 - b. The provisions of ASTM C94 shall apply for acceptance of air content of concrete.
 - c. For critical applications, the air content of concrete shall be measured at greater frequencies than that required for strength tests during the initial part of the project as stated in contract documents.
3. Slump: ASTM C143; one test when concrete is sampled for strength tests. For mixtures approved as self consolidating concrete, measure slump flow at the same frequency as above in accordance with ASTM C1611.
4. Temperature: ASTM C1064; one test when concrete is sampled for strength tests.
5. Density: ASTM C138; one test when concrete is sampled for strength tests.
6. Test results shall be reported by the testing laboratory to the architect, engineer, concrete producer, concrete contractor, and general contractor and/or construction manager within 48 hours of testing.
7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
8. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.
- 3.23 FIELD QUALITY CONTROL FOR FLOOR TOPPING
- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings shall take place in successive stages, in areas of extent and using methods as follows:

1. Sample Sets: At point of placement, a set of 3 molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft., plus 1 set of samples for each subsequent 5000 sq. ft. of topping, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109/C 109M for compliance with compressive-strength requirements.
 2. Concrete floor topping shall be tested for delamination by dragging a steel chain over the surface.
 3. Concrete floor topping shall be tested for compliance with surface flatness and levelness tolerances.
- C. Remove and replace applications of concrete floor topping where test results 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.

END OF SECTION 03 30 00

SECTION 035300 - LIGHTWEIGHT CONCRETE TOPPING

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 lightweight cast-in-place concrete topping for balconies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
- B. Comply with the following sections of ACI 301, unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Reinforcement and Reinforcement Supports."
 - 3. "Concrete Mixtures."
 - 4. "Handling, Placing, and Constructing."
 - 5. "Lightweight Concrete."
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C150, Type I or Type II.
- B. Lightweight Aggregate: ASTM C330, 1/2-inch nominal maximum aggregate size.
- C. Water: ASTM C94/C94M.
- D. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches long.

2.2 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Comply with ASTM C494/C494M.

2.3 RELATED MATERIALS

- A. Building Paper: ASTM D226, Type I (No. 15 asphalt-saturated organic felt). Provide as an interface between concrete pour and plywood sheathing substrates.

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- B. Water: Potable.

2.5 CONCRETE MIXTURES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Structural Lightweight Concrete Mix: ASTM C330, proportioned to produce concrete with a minimum compressive strength of 3000 psi at 28 days and a calculated equilibrium unit weight of 110 lb/cu. ft. plus or minus 3 lb/cu. ft., as determined by ASTM C567. Concrete slump at point of placement shall be the minimum necessary for efficient mixing, placing, and finishing.
 - 1. Limit slump to 4 inches.
- C. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate but not less than a rate of 1.0 lb/cu. yd.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and furnish batch ticket information.
 - 1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.3 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Consolidate concrete with mechanical vibrating equipment.

3.4 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- D. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete open corridors. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.5 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

- C. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301.
1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

3.7 REPAIRS

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

END OF SECTION 035300

SECTION 035413 - GYPSUM 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 gypsum-cement-based, self-leveling underlayment for application below interior floor coverings.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.
- C. Minutes of preinstallation conference.

1.5 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.
- C. Fire-Resistance Ratings: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for fire resistance per ASTM E119 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.

- D. Sound Transmission Characteristics: Where indicated, provide gypsum-cement underlayment systems identical to those of assemblies tested for STC and IIC ratings per ASTM E 90 and ASTM E 492 by a qualified testing agency.
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 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 gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 deg F and 80 deg F.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 GYPSUM-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in required thickness and can be feathered at edges to match adjacent floor elevations.
 - 1. Basis of Design Product: Maxxon Corporation; Gyp-Crete. Other acceptable manufacturers:
 - a. Ardex.
 - b. USG Corporation.
 - 2. Compressive Strength: Not less than 2000 psi at 28 days when tested according to ASTM C109/C109M.
 - 3. Dry Density: 100 lbs.
 - 4. Surface Burning Characteristics: 0 for flame spread, fuel contributed, and smoke density; ASTM E84.

- B. Water: Potable and at a temperature of not more than 70 deg F.
- C. Reinforcement: Maxxon Reinforcement.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

2.2 ACCESSORIES

- A. Sound Mat:
 - 1. Basis of Design Product: Maxxon Corporation; Acousti-Mat.

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. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
 - 1. Install underlayment reinforcement recommended in writing by manufacturer.
- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
- D. Sound Control Mat: Install sound control materials according to manufacturer's written instructions.

1. Do not install mechanical fasteners that penetrate through the sound control materials.

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.
 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
 1. 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 035413

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. Concrete building brick.
3. Clay face brick.
4. Anchored stone veneer.
5. Mortar and grout.
6. Steel reinforcing bars.
7. Masonry-joint reinforcement.
8. Ties and anchors.
9. Embedded flashing.
10. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete"
2. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 07 21 00 "Thermal Insulation" for extruded polystyrene cavity wall insulation.
4. Section 07 23 00 "Continuous Insulation" for polyisocyanurate cavity wall insulation.
5. Section 07 62 00 "Sheet Metal Flashing and Trim" for 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 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For ties and anchors in veneer assemblies with cavity widths exceeding prescriptive design limits.
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
 - 3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
 - 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- D. Samples for Verification: For each type and color of exposed materials.

1.6 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. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For exposed brick, include test report for efflorescence according to ASTM C67.
 - c. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C67.
 - d. For masonry units, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Mortar admixtures.
 - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 5. Grout mixes. Include description of type and proportions of ingredients.
 - 6. Reinforcing bars.
 - 7. Joint reinforcement.
 - 8. Anchors, ties, and metal accessories.
- D. 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 C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- F. 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. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockup(s) [as shown on Drawings] [for typical exterior wall in sizes approximately 84 inches long by 84 inches high by full thickness], including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in mockup.
 - b. Include window opening in exterior wall mockup. Make window approximately 18 inches wide by 24 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).
 - d. Include framing, sheathing, water-resistive barrier, veneer anchors, flashing, cavity drainage material, weep holes and exterior finish materials in exterior masonry-veneer wall mockup.
 2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
 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 Architect specifically approves such deviations in writing.
 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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. 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. Store preblended, dry mortar mix in delivery containers on elevated platforms 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.

1.9 FIELD 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 TMS 602/ACI 530.1/ASCE 6.
 - 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 TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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.
- B. 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.

2.2 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 from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. 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.
- B. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

- C. Concrete Building Brick: ASTM C55.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **[2800 psi] [3050 psi] [3750 psi] [4050 psi] <Insert value>**.
 2. Density Classification: **[Normal weight]**.
 3. Size (Actual Dimensions): 3-5/8 inches wide by **[2-1/4 inches] [2-3/4 inches] [3-5/8 inches]** high by 7-5/8 inches long.

2.5 CONCRETE AND MASONRY LINTELS

- A. Coordination: See Structural Drawings for reinforcing requirements.
- B. General: Provide one of the following:
1. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.
 2. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 30 00 "Cast-in-Place Concrete," and with reinforcing bars indicated.
 3. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, 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.

2.6 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216.
1. Grade: SW.
 2. Type: FBS.
 3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 4. Application: Use where brick is exposed unless otherwise indicated.
 5. Basis of Design: Glen-Gery; Olde Detroit.
 - a. Type: Face Brick.
 - b. Style: Extruded.
 - c. Series: Element Series.
 - d. Texture: Papercut.
 6. Provide lipped brick units at relief angles where required to maintain consistent width of horizontal bed joints.

2.7 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, 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.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. Lafarge Holcim.
 - 2. Lehigh Hanson; Heidelberg Cement Group.
- E. Mortar Cement: ASTM C1329/C1329M.
 - 1. Lafarge Holcim.
 - 2. Lehigh Hanson; Heidelberg Cement Group.
- F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 - 1) Holcim (US) Inc; Rainbow Mortamix Custom Color Cement/Lime.
 - 2) Lafarge North America Inc.; Eaglebond Portland & Lime.
 - 3) Lehigh Hanson; Heidelberg Cement Group; 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.
- G. Aggregate for Mortar: ASTM C144.
 - 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.
- H. Aggregate for Grout: ASTM C404.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. GCP Applied Technologies Inc.

J. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.
 - c. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: 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. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.
 - c. Wire-Bond.
2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.9 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. 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 A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 2. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 4. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. 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.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire.
- D. Partition Top Anchors: 0.105-inch-thick metal plate with a 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.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.
- F. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
 2. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 3. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a 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.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Heckmann Building Products, Inc.; Pos-I-Tie.
 - 2) Hohmann & Barnard, Inc; 2-Seal Tie.
 - 3) Wire-Bond; Sure Tie Anchoring System #4520, #4530, #4510, SureTie.
 - b. Provide anchors with appropriate screw type for each backup material.

2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 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 where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 5. Solder metal items at corners.
- B. Flexible Flashing: For flashing not exposed to the exterior, use the following:
1. Laminated Stainless Steel Flashing: Type 304 stainless steel core with polymeric fabric laminated to one face with non-asphaltic adhesive.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Hohmann & Barnard; Mighty-Flash.
 - 2) Wire-Bond; Bond-N-Flash.
 - 3) York Manufacturing, Inc.; Multi-Flash SS.
- C. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch.
- D. End Dams, Outside, and Inside Corners; Provide flashing manufacturer's pre-fabricated corners and end dams fabricated of 26 gauge stainless steel. Field-fabricated corners are not acceptable.
- E. Metal Drip Edge: Fabricate metal drip edges 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.
- F. 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 fully concealed, use flexible flashing with metal drip edge..
- G. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
- H. 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.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, 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 D2000, Designation M2AA-805 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 felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity 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 range.
 - a. Heckmann Building Products, Inc.; No. 85 Cell Vent.
 - b. Hohmann & Barnard, Inc.; QV Quadro-Vent.
 - c. Wire-Bond; Cell Vent #3601.
- 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:
 - a. Mortar Net USA, Ltd.; Mortar Net (NO SUBSTITUTIONS).
 - 2. Configuration:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
- F. Mortar/Grout Screen: Polypropylene monofilament mesh (1/4-inch grid) designed to isolate flow of grout and mortar in designated areas.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hohmann & Barnard, Inc.; MGS Mortar/Grout Screen.
 - b. Wire-Bond; Grout Stop (#3612).

2.12 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. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - b. EaCo Chem, Inc.
 - c. Prosoco, Inc.

2.13 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. For exterior masonry, use portland cement-lime mortar.
 4. For reinforced masonry, use portland cement-lime mortar.
 5. 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 C270, 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 masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type M or Type S.
 3. For mortar parge coats, use Type S.
 4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
- D. Pigmented Mortar: Use colored cement product.
1. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Clay face brick.
 - b. Cast-stone trim units.
- E. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

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 the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that impair mortar bond.

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 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. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

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: As indicated on Drawings; 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 stepping 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 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 nonload-bearing 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. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- 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 cast-stone 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.
 4. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush where indicated to receive waterproofing.
- F. Cut joints flush where indicated to receive fluid-applied air barrier.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
 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-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.
 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: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation using one of the following:
 - a. The Dow Chemical Company; Great Stuff Pro Gaps and Cracks.
 - b. Tremco Incorporated; Low Expanding Foam, ExoAir LEF.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints.
 - 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 16 inches o.c. horizontally, with not less than one anchor for each 1.77 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
- B. Provide airspace between back of masonry veneer and backup wall as indicated on Drawings.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

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.
- 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 corners, 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 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 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 as follows:
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick as follows:
 - 1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace 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.
 - 2. Install lipped brick below relief angles to maintain consistent width of bed joints.

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or 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.
- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY 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 cavity 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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 6 inches above top of cavity drainage material, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 6 inches above top of cavity drainage material. Fasten upper edge of flexible flashing to sheathing through termination bar.
 4. 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.
 5. End dams, Inside and Outside corners shall be pre-fabricated from the flashing manufacturer. Field fabricated end dams, inside and outside corners are not permitted.
 6. 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 reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep vents in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
 2. Space weep holes 16 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- 3.13 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: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
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. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

- F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.
- G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.
- H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for compressive strength.
- I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.
- J. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

3.14 CLEANING

- A. Clean masonry in accordance with masonry unit manufacturer's written instructions and recommendations.
- B. 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.
- C. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
- D. 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.

3.15 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess masonry waste and legally dispose of off Owner's property.

END OF SECTION

SECTION 042113 - THIN BRICK VENEER

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. Thin brick veneer over water-resistive barrier on sheathing substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each specified product. Include physical and performance data and manufacturer's installation instructions.
- B. Shop Drawings: Dimensioned plans and elevations. Large scale details of connections, joint conditions, and related components.
- C. Samples: 5 samples of thin brick veneer units to illustrate color, texture, and size range of each required unit type.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For dimension thin brick veneer to include in maintenance manuals.

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. Thin Brick Veneer: Furnish quantity of full-size units equal to 5 percent of amount installed, for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

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.
- B. Store thin brick veneer units 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.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install thin brick veneer 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.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence thin brick veneer installation with other work to minimize possibility of damage and soiling during remainder of construction period.

PART 2 - PRODUCTS

2.1 THIN BRICK VENEER

- A. Face Brick: Facing brick complying with ASTM C216.
 1. Basis of Design Manufacturer: To be selected by Architect.
 2. Grade: SW.
 3. Type: FBS.
 4. Thin Veneer Brick Conformance Standard: ASTM C1088.

5. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
6. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C67.
7. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
8. Size (Actual Dimensions): 2-1/4 inches high by 7-5/8 inches long by 5/8 inch thick.
9. Color and Texture: To be selected by Architect.

2.2 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 1. Basis of Design Manufacturer: Laticrete International, Inc. An equivalent product by one of the following manufacturers is also acceptable:
 - a. Bonsal American; an Oldcastle company.
 - b. Custom Building Products.
 - c. MAPEI Corporation.
 - d. TEC; a subsidiary of H. B. Fuller Company.
 2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

2.3 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

2.4 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and with mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. 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 thin brick veneer will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 THIN BRICK VENEER INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Stone, and Glass Tile Installation" for TCNA installation methods specified in thin brick veneer installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods specified in thin brick veneer installation schedules, and apply to types of setting and grouting materials used.
- B. Wipe backs of thin brick veneers with a damp cloth to remove dirt and dust before units are installed.
- C. Extend thin brick veneer 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.
- D. Accurately form intersections and returns. Perform cutting and drilling of thin brick veneer without marring visible surfaces. Carefully grind cut edges of thin brick veneer abutting trim, finish, or built-in items for straight aligned joints. Fit thin brick veneer closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap thin brick veneer.
- E. Jointing Pattern: Lay thin brick veneer in pattern indicated on Drawings. Lay out thin brick veneer work and center thin brick veneer fields in both directions in each space or on each wall area. Lay out thin brick veneer work to minimize the use of pieces that are less than half of a brick. Provide uniform joint widths unless otherwise indicated.
 - 1. Joint Widths: As indicated on Drawings.
- F. Lay out thin brick veneer wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Match thin brick veneers within each space by selecting tiles to achieve uniformity of color and pattern. Reject or relocate thin brick veneers that do not match color and pattern of adjacent tiles.

- H. Mix thin brick veneers to achieve a uniformly random distribution of color shadings and patterns.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: For vertical joints, external corners, and other conspicuous lines, do not exceed 1/8 inch in 8 feet.
- B. Variation in Level: For horizontal joints and other conspicuous lines, do not exceed 1/8 inch in 10 feet, or 1/2 inch maximum.
- C. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/32 inch difference between faces of adjacent units as measured from a straightedge parallel to thin brick veneered surface:

3.4 ADJUSTING AND CLEANING

- A. Remove and replace material that is stained or otherwise damaged or that does not match adjoining thin brick veneer. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean thin brick veneer surfaces so they are free of foreign matter.

3.5 THIN BRICK VENEER INSTALLATION SCHEDULE

- A. Exterior Wall Installations, Metal Studs or Furring:
 - 1. TCNA Installation W244: Thin-set mortar on sheathing.
 - a. Thin-Set Mortar: Latex-portland cement mortar.
 - b. Grout: Sand-portland cement grout.

END OF SECTION 042113

SECTION 042200 - 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 for elevator and stair core elements.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.

- B. Related Requirements:

1. Section 055000 "Metal Fabrications" for furnishing steel lintels for unit masonry.

1.3 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 from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
1. Masonry units.
 - a. Include data on material properties.
 - 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. Grout mixes. Include description of type and proportions of ingredients.
 4. Reinforcing bars.
 5. Joint reinforcement.
 6. 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 C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91 for air content.
 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Preinstallation Conference: Conduct conference at Project site.

1.7 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. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 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. 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 7 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.

2.2 CONCRETE MASONRY UNITS

- A. 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 square-edged units for outside corners.
- B. CMUs: ASTM C90.
 - 1. Density Classification: Lightweight unless otherwise indicated.
 - 2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions indicated on Drawings.
 - 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150, 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.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. White-Mortar Aggregates: Natural white sand or crushed white stone.
- D. Aggregate for Grout: ASTM C404.
- E. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 2. Wire Size for Side Rods: 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 0.148-inch diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 5. 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.

2.5 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 A82/A82M; with ASTM A153/A153M, Class B-2 coating.
 - 2. Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, 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 D2000, Designation M2AA-805 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 D226, Type I (No. 15 asphalt felt).

2.7 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.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For reinforced masonry, use Type S.
 - 2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls, use Type N.
- C. Grout for Unit Masonry: Comply with ASTM C476.
 - 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 C476, 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 C143/C143M.

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. General: Comply with NCMA TEK Notes for dimensions, locations of elements, lines and levels, and joints.

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.

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 grouted masonry, including starting course on footings.
 - 3. 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 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 as indicated on Drawings.

3.8 LINTELS

- A. Install steel, masonry, and/or precast lintels as indicated on the Drawings.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- B. 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.

3.10 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 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.

3.11 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.

END OF SECTION 042200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Elevator machine hoist beams.
3. Steel shapes for supporting elevator door sills.
4. Metal ladders.
5. Metal bollards.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

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

- B. Shop Drawings: Show fabrication and installation details all specified metal fabrications. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

- C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Florida, responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

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 B633 or ASTM F1941, 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 A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- 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/E 488M, conducted by a qualified independent testing agency.
- E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. 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.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

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 are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, 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. Galvanize miscellaneous framing and supports where indicated.

2.7 METAL LADDERS

- A. General:
 1. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Pit Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. 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.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallurgically bonded to rung.
 - a. Products: Provide the following:
 - 1) SlipNOT Metal Safety Flooring, a division of W. S. Molnar Company; SlipNOT.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

2.8 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.

2.9 FINISHES, GENERAL

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

2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in 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 grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

3.4 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 A780/A780M.

END OF SECTION 055000

SECTION 055113 - 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 precast concrete treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for additional precast concrete tread requirements.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for 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 do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Precast concrete treads.
 - 2. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For stair railings and each type and finish of nosing.
- D. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Florida, responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Florida, to design stairs and railings.
- 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.

2.2 METALS

- 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.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500 (cold formed) or ASTM A513.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc-rich primer. Provide one of the following products or acceptable equivalent:
 1. Benjamin Moore & Co.; Super Spec HP Alkyd Metal Primer.
 2. PPG Architectural Coatings; Speedhide Int/Ext Rust Inhibitive Steel Primer.
 3. The Sherwin-Williams Company; Kem Kromik Universal Primer.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 PRECAST CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 5000 psi and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter wire; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
- C. Provide integral aluminum oxide or silicon carbide abrasive strips as detailed on Drawings.

2.6 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.
- 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 exposed work with accurate angles and surfaces and straight edges.
- E. 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 3 welds: partially dressed weld with spatter removed.
- F. 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.

2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 - 2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Risers: Provide steel C channels welded to stringers.
 - 5. Precast Concrete Tread Supports: Provide welded steel angle configurations indicated on Drawings. Weld to stringers.
 - 6. 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 do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

2.8 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.
 - 1. Rails and Posts: 1-1/2-inch diameter top and bottom rails and 1-1/2-inch diameter posts.
 - 2. Picket Infill: 1/2-inch round pickets spaced less than 4 inches clear.
- 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 are okay as shown in NAAMM AMP 521.
- C. Form changes in direction of railings as detailed.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- 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. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 2. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except 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.
- D. Powder-Coat Finish, Stair Railings: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare railing surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
 - 4. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLING METAL STAIRS

- 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.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

- G. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 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 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. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 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 055113

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Shear wall panels.
 - 4. Rooftop equipment bases and support curbs.
 - 5. Wood blocking and nailers.
 - 6. Wood sleepers.
 - 7. Plywood backing panels.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

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 D5664.
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.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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 or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with 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, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply 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 E84, 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. Treatment shall 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 D2898. 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 D3201 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 D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat **[all rough carpentry unless otherwise indicated.] [items indicated on Drawings, and the following:]**
1. Framing for raised platforms.
 2. Framing for stages.
 3. Concealed blocking.
 4. Framing for non-load-bearing partitions.
 5. Framing for non-load-bearing exterior walls.
 6. Roof construction.
 7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: No. 2 grade.
1. Application: Interior partitions not indicated as load bearing.
 2. Species:
 - a. Southern pine or mixed southern pine; SPIB.
- B. Load-Bearing Partitions: No. 2 grade.
1. Application: Exterior walls and interior load-bearing partitions.
 2. Species:
 - a. Southern pine; SPIB.
- C. Ceiling Joists No. 2 grade.
1. Species:
 - a. Southern pine; SPIB.
- D. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
1. Species:

- a. Southern pine; SPIB.

~~E. Exposed Framing [Indicated to Receive a Stained or Natural Finish]: Hand select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.~~

2.5 ENGINEERED WOOD PRODUCTS

- A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 - 1. See drawings for manufacturer and specifics.
- C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
 - 1. See drawings for manufacturer and specifics.
- D. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.
 - 1. See drawings for manufacturer and specifics.
 - 2. Structural Properties: Depths and design values not less than those indicated.
 - 3. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.
- E. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.
 - 1. See drawings for manufacturer and specifics.
 - 2. Thickness: 1-1/4 inches.
 - 3. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.
- F. Insulated Rim Boards: Insulated product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
 - 1. Manufacturer: Provide products by same manufacturer as I-joists.
 - 2. Rim Board Material: All-veneer product, glued-laminated wood, or product made from any combination solid lumber, wood strands, and veneers
 - 3. Rim Board Thickness: 1-1/4 inches.
 - 4. Insulation: 1-1/2-inch-thick polyisocyanurate foam complying with ASTM C1289.
 - 5. Inside Facing: 7/16-inch-thick OSB.

6. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

2.6 SHEAR WALL PANELS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
- C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized-steel panel, steel top and bottom plates, and wood studs.
- D. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.7 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. Dimension Lumber Items: Construction or No. 2 the following species:
 1. Mixed southern pine or southern pine; SPIB.
- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine or 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.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.9 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.10 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MiTek Industries, Inc.
 - 2. Simpson Strong-Tie Co., Inc
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
 - 1. Use for exterior locations and where indicated.
- F. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.050 inch.
- G. I-Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
 - 1. Thickness: 0.050 inch.
- H. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: 1-1/2 inches.
 - 2. Thickness: 0.050 inch.
- I. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- J. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- K. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches.
 - 2. Thickness: 0.050 inch
 - 3. Length: As indicated.
- L. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
- M. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- N. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.
- O. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - 1. Bolt Diameter: 5/8 inch.
 - 2. Width: 2-1/2 inches.
 - 3. Body Thickness: 0.108 inch.
 - 4. Base Reinforcement Thickness: 0.108 inch.

- P. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
- Q. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.

2.11 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. 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.
- D. Adhesives for Gluing Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- 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. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

- H. Do not splice structural members between supports unless otherwise indicated.
- I. 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.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics do 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.
- L. Comply with AWWPA 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.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- O. 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.

- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with **indicated** fastener patterns where applicable.
 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for 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.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
1. For exterior walls, provide 2-by-6-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
 2. For interior partitions and walls, provide 2-by-6-inch or 2-by-4-inch nominal-size wood studs (as indicated) spaced 16 inches o.c. unless otherwise indicated.
 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions].
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.4 INSTALLATION OF FLOOR JOIST FRAMING

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
 - 1. Where supported on wood members, by using metal framing anchors.
 - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.
- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.
- E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.
- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
 - 1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
 - 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.5 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.6 INSTALLATION OF STAIR FRAMING

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
 1. Size: 2-by-12-inch nominal size, minimum.
 2. Material: Laminated-veneer lumber, parallel-strand lumber, or solid lumber.
 3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
 4. Spacing: At least three framing members for each 36-inch clear width of stair.
- B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

3.7 PROTECTION

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

END OF SECTION

SECTION 061053 - 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. Wood blocking and nailers.
 - 2. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing".

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 D5664.
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.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.

1.6 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.

1.7 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the 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. 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.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent 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.
- 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. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all exterior items, and the following:
 - 1. Wood nailers, blocking, and similar members in connection with roofing and flashing.
 - 2. Wood blocking and similar concealed members in contact with masonry or concrete.
 - 3. Other items indicated on Drawings.

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 E84, 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 D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- 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. Application: Treat plywood backing panels, interior blocking, and other items indicated on Drawings.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. 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, AC, 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. Fastener Material: Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954 depending on metal framing attachment requirements, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 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 E488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, 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.
- G. 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.
- H. 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.
- I. 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 Florida Building Code.
- J. 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 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.

END OF SECTION 061053

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. Roof sheathing.
 - 3. Subflooring.
 - 4. Sheathing joint and penetration treatment.

- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry".

1.3 ACTION SUBMITTALS

- A. Product Data: For each product. Indicate component materials and dimensions and include construction and application details.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wall sheathing with integral water-resistive barrier and air barrier.

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-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.

1. Span Rating: Not less than 32/16.
2. Panel Performance Category: 15/32

- B. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; Saint-Gobain North America; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond® eXP® Sheathing.
 - d. USG Corporation; Securock.
2. Type and Thickness: Type X, 5/8 inch thick.

2.3 WALL SHEATHING WITH INTEGRAL WATER-RESISTIVE BARRIER AND AIR BARRIER

- A. Performance Requirements:

1. Air Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft at 1.57 lb/sq. ft; ASTM E2375.
2. Water-Vapor Permeance, Facer: Minimum 12 perms; ASTM E96/E96M.

- B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing with factory-laminated water-resistive barrier facer.

1. Basis-of-Design Product: Huber Engineered Woods, LLC; ZIP System Sheathing.
2. Span Rating and Performance Category: Not less than 24/16; 7/16
3. Performance Category: 7/16
4. Edge Profile: Square edge Self-spacing.
5. Facer: Medium-density, phenolic-impregnated sheet material qualifying as a Grade D weather-resistive barrier in accordance with ICC AC38.

- C. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC-ES AC148, and tested as part of an assembly meeting performance requirements.

1. Basis-of-Design Product: Huber Engineered Woods, LLC; ZIP System Tape.

- D. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing/weather-barrier and self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendations for integration with system tapes.

1. Basis of Design Product: Huber Engineered Woods, LLC; ZIP System Liquid Flash.

- E. Self-Adhering Flexible Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC-ES AC148, and tested as part of an assembly meeting performance requirements.
 - 1. Basis-of-Design Product: Huber Engineered Woods, LLC; ZIP System – Stretch Tape.
 - 2. Thickness: 0.042 inch.

2.4 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exposure 1 sheathing.
 - 1. Span Rating: Not less than 40/20.
 - 2. Panel Performance Category: 19/32.

2.5 SUBFLOORING

- A. Oriented-Strand-Board Subflooring: DOC PS 2, Exposure 1, Structural I sheathing single-floor panels or sheathing.
 - 1. Product: Huber; Advantech (NO SUBSTITUTIONS).
 - 2. Span Rating: Not less than 24.
 - 3. Panel Performance Category: 23/32.
 - 4. Edge: Tongue and Groove.
 - 5. Maximum Absorption: 9.2 percent.
 - 6. Design Bending Strength: 1250 lbs-in/ft.
 - 7. Minimum Design Bending Stiffness: 380,000 lb-in²/ft.

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. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

- G. Screws for Fastening Composite Nail Base Insulated Roof 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 B117. Provide washers or plates if recommended by sheathing manufacturer.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.8 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall 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.

- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. 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. Combination Subfloor-Underlayment:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 2. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 3. Wall and Roof Sheathing:
 - a. Nail to wood framing.[Apply a continuous bead of glue to framing members at edges of wall sheathing panels.]
 - b. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
- 3.4 JOINT TREATMENT FOR INTEGRAL WATER-RESISTIVE BARRIER SHEATHING
- A. Zip System Sheathing (Transition "tape"):
1. Apply ZIP System tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.
 2. Apply Huber liquid-applied flashing membrane at penetrations, gaps, cracks and where Zip sheathing joins to concrete or concrete masonry units, to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with ZIP System Tape.
 3. Apply ZIP System Stretch Tape around window and window frames, door frames, radius fenestrations and wall penetrations to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of IAPMO ER365 applicable to tape application.
- 3.5 FLEXIBLE OR LIQUID APPLIED FLASHING INSTALLATION
- A. Apply manufacturer's flashing products where indicated to comply with manufacturer's written instructions.
1. After flexible flashing tape has been applied, roll surfaces with a hard rubber roller to ensure that flashing is completely adhered to substrates.
 2. Width for flexible flashing: 6 inch.
 3. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with system tape.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

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 roof trusses.
 2. Wood floor trusses.
 3. Wood girder trusses.

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from 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 from 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 D5664.
 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
- B. Shop Drawings: Show fabrication and installation details for trusses.
1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 2. Indicate sizes, stress grades, and species of lumber.
 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.

4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 6. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses 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 professional engineer.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
 1. Metal-plate connectors.
 2. Metal truss accessories.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that [participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction] [and] [is certified for chain of custody by an FSC-accredited certification body].
- C. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.

2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
1. Design Loads: As indicated.
 2. Maximum Deflection under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span.
 - b. Floor Trusses: Vertical deflection of 1/360 of span.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Provide dressed lumber, S4S.
 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal for top chords.
- C. Minimum Specific Gravity for Top Chords: 0.55.
- D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CompuTrus, Inc.
 2. Eagle Metal Products.
 3. Jager Building Systems, Inc.
 4. MiTek Industries, Inc.
 5. Robbins Engineering, Inc.
 6. Truswal Systems Corporation.
- B. Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
1. Use for wood-preserved-treated lumber and where indicated.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, and not less than 0.035 inch thick.
1. Use for exterior locations and where indicated.

2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 2. Where trusses are exposed to weather, in ground contact, made from pressure-preserved-treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.
- B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
 - 1. Use for exterior locations and where indicated.
- E. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to one side of truss, top plates, and side of stud below.
- F. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.
- G. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
- H. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- I. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch-long seat; formed from metal strap 0.062 inch thick with tabs bent to extend over and be fastened to supporting member.
- J. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.
- K. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.
 - 1. Angle clip is 3 by 3 by 0.179 by 8 inches with extended leg 8 inches long. Connector has galvanized finish.
 - 2. Angle clip is 3 by 3 by 0.239 by 10-1/2 inches with extended leg 10-1/2 inches long. Connector has painted finish.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.8 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses 24 inches o.c; adjust and align trusses in location before permanently fastening.

- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND 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 wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION

SECTION 062023 - INTERIOR FINISH 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. Interior trim.
- 2. Shelving.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
- 2. Section 099100 "Painting" for priming and backpriming of interior finish carpentry.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20.
- B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece.

2.2 INTERIOR TRIM

- A. Moldings for Opaque Finish (Painted Finish): Made to patterns included in WMMPA WM 12.
 - 1. Hardwood Moldings: WMMPA HWM 2, P-grade.
 - a. Species: Yellow poplar.
 - b. Maximum Moisture Content: 9 percent.
 - 2. Finger Jointing: Allowed.
 - 3. Moldings for Common/Amenity/Leasing Areas:
 - a. Base Moulding: 7/16 inch by 5-1/4 inch primed finger-joint baseboard with eased edges. Provide Metrie 431J or comparable equivalent.
 - b. Case Moulding: 9/16 inch by 3-1/2 inch primed finger-jointed cased with eased edges. Provide Metrie 472J or comparable equivalent.
 - c. Window Sill: 1 x S4S Poplar with eased edge, ripped to width. To extend 1-1/2 inches beyond gypsum board surface with casing below.

- d. Window Jambs and Head: Gypsum board wrapped opening. Paint grade, unless indicated otherwise.

4. Moldings for Residential Units:

- a. Base Moulding: 7/16 inch by 3-1/4 inch primed finger-joint baseboard with eased edges. Provide Metrie ZZ433LJ or comparable equivalent.
- b. Case Moulding: 9/16 inch by 2-1/2 inch primed finger-jointed cased with eased edges. Provide Metrie 9933PRI or comparable equivalent.
- c. Shoe Moulding: 1/2 inch by 3/4 inch primed finger-joint shoe. Provide Metrie 126J or comparable equivalent.
- d. Window Sill: 1 x S4S Poplar with eased edge, ripped to width. To extend 1-1/2 inches beyond gypsum board surface with casing below.
- e. Window Jambs and Head: Gypsum board wrapped opening. Paint grade, unless indicated otherwise.

2.3 SHELVING

- A. Open Shelving: 1 x 12 S4S Poplar shelves with eased edges. Paint grade unless otherwise indicated.
- B. Shelf Cleats: 1 x 2 S4S Poplar cleats. Paint grade unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.5 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - 1. Interior standing and running trim except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting

joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Install trim after gypsum-board joint finishing operations are completed.
2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 SHELVING AND CLOTHES ROD INSTALLATION

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
- B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c.
 1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- C. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
 1. Fasten shelves to cleats with finish nails or trim screws, set flush.

3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Plastic-laminate-faced architectural cabinets.
- 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 061053 "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 123530 "Residential Casework."
- 3. Section 123663 "Quartz Agglomerate Countertops."

1.3 ACTION SUBMITTALS

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

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

- 1. Show 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 architectural plastic-laminate cabinets.
- 3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of product.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 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. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Fabricator of products.

1.6 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.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. 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.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that 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. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Basis of Design Manufacturer: As scheduled on Drawings.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.

- a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide thermoset decorative panels.
2. Drawer Sides, Backs, and Bottoms: Thermoset decorative panels with PVC edge banding.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. 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.
- J. Colors, Patterns, and Finishes: As scheduled on Drawings.

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: 8 to 13 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, made with binder containing no urea formaldehyde.
 3. Softwood Plywood: DOC PS 1.
 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 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.

- B. Back-Mounted Pulls: BHMA A156.9, B02011.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 3. For drawers provide Grade 1HD-100.
- E. Door Locks: BHMA A156.11, E07121.
- F. Drawer Locks: BHMA A156.11, E07041.
- G. Door and Drawer Silencers: BHMA A156.16, L03011.
- H. 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.
- I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

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

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.

- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- 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 blocking or hanging strips and No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 064116

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

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. Modified bituminous sheet waterproofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials and protection course from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil thick, polyethylene-film reinforcement, and with release liner on adhesive side.
1. Products: Provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - b. CETCO; Envirosheet.
 - c. GCP Applied Technologies; Grace Bituthene 4000.
 - d. Meadows, W.R.,Inc; SealTight Mel-Rol.
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E154.
 - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
 - g. Water Vapor Permeance: 0.05 perms maximum; ASTM E96/E96M, Water Method.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- D. Protection Course: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
1. Thickness: 1/4 inch, nominal.
 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

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 waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing 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.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet-waterproofing terminations with mastic.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- G. Immediately install protection course with butted joints over waterproofing membrane.

3.4 FIELD QUALITY CONTROL

- A. Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Prepare test and inspection reports.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071356 - BALCONY DECK WATERPROOFING 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. Section Includes:

1. Self-adhering sheet waterproofing.
2. Galvanized metal flashing components.
3. Extruded aluminum balcony edge flashing and fascia.

- B. Related Requirements:

1. Section 071356 "Balcony Deck Waterproofing System" for balcony waterproofing system.
2. Section 071800 "Traffic Coatings" for pedestrian traffic coatings on balcony surfaces.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, flashings, metal materials and fabrications, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
 - a. Extent: One complete balcony as selected by Architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. **Warranty Period:** 10 years from date of Substantial Completion.
- B. **Installer's Special Warranty:** Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Basis of Design System:** Stone Table LLC; Cemplex Pocket. Incorporates premanufactured sheet metal assemblies as components of deck waterproofing system.

2.2 SHEET WATERPROOFING

- A. **Self-Adhering Membrane Waterproofing:** 60-mil thick rubberized asphalt membrane consisting of a high-density polyethylene film bonded to a layer of rubberized asphalt.
 - 1. **Basis of Design Product:** Polyguard Products Inc.; Polyguard 650 Membrane.

2.3 SHEET METALS

- A. **Aluminum Sheet and Extrusions:** ASTM B209 sheet and ASTM B221 extrusions. Alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. **Clear Anodic Finish:** AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. **Metallic-Coated Steel Sheet:** Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation.
 - 1. **Surface:** Smooth, flat.

2.4 AUXILIARY MATERIALS

- A. **General:** Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

- B. Surface Primer Adhesive: Roller grade adhesive. Provide one of the following by Polyguard Products Inc.:
 - 1. Polyguard 650 LT Liquid Adhesive: Rubber-based adhesive.
 - 2. Polyguard California Sealant: Rubber-based sealant.
 - 3. Polyguard Shur-Tac Liquid Adhesive: Polymer emulsion based adhesive.
- C. Detail Tape: Rubberized-asphalt waterproofing membrane laminated to polypropylene backing. For inside/outside corner applications, at penetrating items, and patching damaged areas. Provide Polyguard's "Polyguard Detail Tape."
- D. Liquid Membrane: Two-component, trowel-applied, asphalt modified urethane waterproofing membrane. Provide Polyguard's "Polyguard LM-95 Liquid Membrane."
- E. Detail Sealant: Single-component elastomeric sealant. Provide Polyguard's "Polyguard Detail Sealant PW."
- F. Mastic: Asphalt/rubber-based mastic for termination edges, overlaps, and patches. Provide Polyguard's "Polyguard 650 Mastic."
- G. Drainage Composite: Two-part, prefabricated, geocomposite drain consisting of a formed polystyrene core covered on one side with polypropylene filter fabric. Provide Polyguard's "Polyguard Polyflow 15 Drainage Mat."

2.5 METAL COMPONENT FABRICATION

- A. General: Fabricate metal flashing and trim components to comply with details shown. Fabricate components in shop to greatest extent possible.
 - 1. Fabricate metal flashing and trim in thicknesses indicated on Drawings.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form metal flashing and trim to fit substrates true to line, levels, and slopes.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Fabricate attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

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 waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing 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.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 SELF-ADHERED MEMBRANE WATERPROOFING INSTALLATION

- A. Install self-adhered membrane waterproofing system over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D5843.
- B. Priming: Apply primer by roller or spray and manufacturer's recommended rate.
- C. Inside and Outside Corners: Treat with membrane strips or specified detail sealant or liquid membrane.

- D. Membrane Laps: Minimum 8 inch side laps and 6 inch minimum staggered end laps.
- E. Firmly roll entire membrane with minimum 75 lb. linoleum roller immediately after application, to ensure proper adhesion and minimize air pockets between substrate and membrane.
- F. Penetrations, Posts, and Projections: Seal with specified detail sealant or liquid membrane.
- G. Terminate membrane turned up on walls with detail sealant or liquid membrane.
- H. Drainage Composite Course: Apply drainage composite according to manufacturer's written installation instructions.

3.4 METAL FLASHING AND TRIM INSTALLATION

- A. General: Install metal flashing and trim to comply with manufacturer's written installation instructions. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
 - 1. Extruded aluminum balcony edge flashing and fascia.
- B. Extruded Aluminum Balcony Edge Flashing and Fascia Assembly: Anchor to resist Project uplift and outward forces. Install in sequence with elastomeric sheet waterproofing and galvanized metal drip edge flashing according to approved shop drawings.
- C. Galvanized Metal Flashing: Install galvanized metal counterflashing, L profile flashing, and prefabricated corner units, and sequenced with elastomeric sheet waterproofing, according to approved shop drawings.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending 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 minimum of 4 inches. Secure in waterproof manner as detailed on Drawings.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.

- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071356

SECTION 071716 - COMPOSITE SHEET WATERPROOFING

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 applications of composite sheet waterproofing:

- 1. Exterior of walls below grade.
- 2. Beneath slabs below grade.

- B. Related Requirements:

- 1. Refer to Drawings for excavating and backfilling.
- 2. Section 003300 "Cast-in-Place Concrete" for forms, waterstops, and concrete placement.

1.3 SUBMITTALS

- A. Product Data: For each material and type of application required. Include product specifications and manufacturer's written installation instructions and recommendations.
- B. Samples: Of each of the following products in sizes indicated:
 - 1. Waterproofing Panels: 6 inches square for each specified panel.
 - 2. Drainage Composite: 6 inches square.
 - 3. Protection Course: 6 inches square.
- C. Material Certificates: Signed by waterproofing system manufacturer certifying materials comply with specified performance characteristics and physical requirements. Include certification that waterproofing system and components, drainage, and protection materials are supplied by a single-source manufacturer.
- D. Test Report: Manufacturer's test report on water samples taken at Project site along with recommendations resulting from these tests.
- E. Warranty: Specimen of specified waterproofing warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has specialized in installing composite sheet waterproofing systems similar to those required for this Project and who is licensed by or otherwise acceptable to manufacturer of primary materials.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing a composite sheet waterproofing system similar to that indicated for this Project and with a record of successful in-service performance.
- C. Single Source Responsibility: Obtain composite sheet waterproofing system through one source from a single manufacturer. Obtain accessory products used in conjunction with composite sheet waterproofing from sources acceptable to composite sheet waterproofing manufacturer.
- D. Preinstallation Conference: Approximately 2 weeks before scheduled start of waterproofing installation, meet at Project site with waterproofing Installer; preparer of substrate to receive waterproofing; installers of other work in and around waterproofing that must precede, follow, or penetrate, or is contiguous to waterproofing (including mechanical and electrical installers as applicable); Architect; Owner; and waterproofing manufacturer's representative to review materials, procedures, schedules, and other requirements and conditions related to installing composite sheet waterproofing.
- E. Water Samples: Obtain water samples from Project site at approximate locations where waterproofing will be installed and have waterproofing manufacturer test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials. Comply with manufacturer's written instructions resulting from these tests.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Handle and store materials complying with manufacturer's published instructions and material safety data sheets.
- B. Deliver materials to Project site in manufacturer's original unopened and undamaged containers.
- C. Store materials in a dry, well-ventilated space.
- D. Remove and replace composite sheet materials that have been prematurely exposed to moisture.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Do not apply waterproofing materials to surfaces where ice or frost is visible. Composite sheet products in panel or membrane form may be placed on damp surfaces. Do not apply composite sheet waterproofing materials in areas with standing water.
- B. Comply with manufacturer's written instructions regarding weather conditions before and during waterproofing installation, condition of the substrate to receive waterproofing, and protection of the installed waterproofing system.

1.7 WARRANTY

- A. Special Warranty: Submit a written warranty, signed by manufacturer and applicator, agreeing to repair or replace components of composite sheet waterproofing system that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Water penetrating the building or structure.
 - 2. Deteriorated or displaced waterproofing materials.
- B. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Products: CETCO; Ultraseal BT Membrane and Ultraseal SP Membrane.
 - 1. Acceptable Equivalent System: GCP Applied Technologies; GRACE Preprufe Membrane.

2.2 WATERPROOFING MEMBRANES

- A. Ultraseal BT Membrane: 100 mil thick composite membrane consisting of an active-polymer core (APC) integrally bonded to a geomembrane liner using a proprietary mechanical process. Applicable for backfilled foundation walls.
 - 1. Performance Properties:
 - a. Hydrostatic Pressure Resistance: 231 feet per ASTM D5385 modified.
 - b. Permeability: 1×10^{-11} cm/sec.
 - c. Puncture Resistance: 130 lbs. min. per ASTM D4833.
 - d. Peel Adhesion to Concrete: 10 lbs./in. per ASTM D903 modified.

- B. Ultraseal SP Membrane: 200 mil thick composite membrane consisting of an active-polymer core (APC) integrally bonded to a geomembrane liner using a proprietary mechanical process. Applicable for use under structural slabs.
 - 1. Performance Properties:
 - a. Hydrostatic Pressure Resistance: 231 feet per ASTM D5385 modified.
 - b. Permeability: 1×10^{-11} cm/sec.
 - c. Puncture Resistance: 130 lbs. min. per ASTM D4833.
 - d. Peel Adhesion to Concrete: 10 lbs./in. per ASTM D903 modified.

2.3 ACCESSORY COMPONENTS

- A. Composite sheet Mastic: Trowelable consistency, composite sheet compound, specifically formulated for application at joints and penetrations.
 - 1. Product: CETCO's "Volclay Bentoseal."
- B. Wall-to-Footing Composite sheet Joint Strip: Manufacturer's standard 2-inch diameter, water-soluble tube containing approximately 1.5 lb/ft. of composite sheet, hermetically sealed, designed specifically for placing on wall footings at line of joint with exterior base of wall.
 - 1. CETCO's "Volclay Hydrobar Tubes."
- C. Preformed Waterstop: Flexible strip of composite sheet waterproofing compound in cartridge or coil form, designed specifically for vertical and horizontal joints in concrete construction.
 - 1. Product: CETCO's "Waterstop-RX."
- D. Drainage Composite: 4 foot by 52 foot roll of three-dimensional polypropylene drainage core with nonwoven geotextile adhered to one side to allow water passage while restricting soil particles. Composite includes a thin polyethylene sheet on back of drainage core.
 - 1. Product: CETCO's "Aquadrain 15XP."
 - 2. Performance Properties:
 - a. Compressive Strength: 15,000 psf.
 - b. Water Flow Rate: 97 gpm/ft.
 - c. Thickness: 7/16 inch.
- E. Base Drain Composite: 1 inch thick by 12 inch high base drain composite designed to collect water from sheet composite drainage and then discharge water to proper sump system or gravity to daylight.
 - 1. Product: CETCO's "Aquadrain 100BD Base Drain."

2. Performance Properties:
 - a. Compressive Strength: 10,000 psf.
 - b. Water Flow Rate: 97 gpm/ft.
 - c. Thickness: 1 inch.
- F. Termination Bar: 1 inch wide aluminum bar with pre-punched holes on 12 inch centers for fastening.
- G. Protection Board: 1/2 inch thick cementitious board.
- H. Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch diameter washers under fastener heads.
- I. Seam Tape: 2 inch wide butyl rubber sealant tape.
- J. Sealant and Adhesive: Single-component polyether general sealant and adhesive.
 1. Product: CETCO's "CETSEAL."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations affecting performance of composite sheet waterproofing.
 1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of composite sheet waterproofing.
 2. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Verify that substrate is complete and that all work that will penetrate waterproofing is complete and rigidly installed. Verify locations of waterproofing termination.

3.2 PREPARATION

- A. Coordinate work in the vicinity of waterproofing to ensure proper conditions for installing the waterproofing system and to prevent damage to the waterproofing after installation.

- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with composite sheet mastic or cementitious patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of the concrete or the effectiveness of the waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with composite sheet mastic or cementitious patching material according to manufacturer's written instructions.
- D. Excavation Retention System or Stable Excavation: If water is seeping, use plastic sheets or other suitable means to prevent wetting the composite sheet waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling materials. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Install waterproofing and accessories according to manufacturer's written instructions, standard details, and recommended practices.
 - 1. Apply linear joint-sealing tubes, composite sheet mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
 - 2. Apply granular composite sheet around penetrations in horizontal surfaces according to manufacturer's written instructions.
- B. Construction Joints: Protect construction joints with composite sheet preformed flexible waterstop strips. Either place concrete directly over flexible strips or press strips into preformed cavities. Comply with manufacturer's written instructions for using preformed flexible waterstop strips where joint waterproofing is not otherwise indicated.
- C. Install wall-to-footing composite sheet continuously at base of wall waterproofing (on footing, against wall) according to manufacturer's written instructions.
- D. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.

3.4 MEMBRANE INSTALLATION

- A. Ultraseal BT Membrane: For backfilled walls, install membrane with white liner side outward, away from the concrete, facing the installer. Overlap membrane edges minimum 2 inches; secure with approved fasteners maximum 24 inches on center. Stagger all vertical overlap seams a minimum 12 inches. Tape all membrane overlap seams with specified seam tape.

1. Slab/Backfilled Wall Footing Edge Transition Course: Inside the slab/footing form edge, secure membrane sheet horizontally oriented (white liner side down) to top inside edge of exterior slab/footing form with sheet conforming to interior form surfaces and ten extending out onto horizontal slab substrate a minimum 2 inches. Overlap edges of adjacent membrane sheets a minimum 4 inches and secure to prevent sheet movement during construction or concrete placement.
 2. Place Hydrobar Tubes along wall/footing intersection with ends butted tightly together to form a continuous installation.
- B. Ultraseal SP Membrane: For underslab applications, place membrane directly on properly prepared substrate with white liner side facing down. Overlap membrane edges minimum 4 inches. Stagger sheet end seams a minimum 24 inches. Mechanically fasten or staple membrane 12 inches on center to prevent movement from construction operations or concrete placement. When the slab is poured in sections, extend membrane a minimum 12 inches beyond the slab edge to enable proper overlapping.
- C. Penetrations: For all pipe, rebar, structural, or other penetrations install waterproofing system according to manufacturer's written installation instructions.

3.5 DRAINAGE COMPOSITE INSTALLATION

- A. General: install drain composite components according to waterproofing manufacturer's written instructions.
- B. At base of wall, place base drain composite ("Aquadrain 100BD") horizontally oriented with open core side up and tight against wall over previously installed composite sheet panels for a continuous installation and suitably secured to wall substrates.
- C. Install bottom course of drainage composite ("Aquadrain 15XP") with plastic core side against wall and bottom core edge fully contacting top core edge of base drain composite. Install remainder of courses in shingle overlap fashion to finished grade. Seal all edges according to manufacturer's published instructions. Securely attached panels to wall substrates and terminate at top with termination bar.
- D. During installation, prevent any intrusion of soil into the base drain core and drainage composite core.

3.6 PROTECTION COURSE

- A. Provide specified protection course over completed waterproofing installation. Closely coordinate with backfilling requirements in Earthwork Section to ensure the installed waterproofing system is not damaged during backfill operations.

END OF SECTION 071716

SECTION 071813 - PEDESTRIAN TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes traffic coatings for pedestrian traffic applications at balconies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including installation instructions.
- B. Shop Drawings: For traffic coatings.
 - 1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.
- C. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
 - 1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of traffic coating.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
 - 1. Do not apply traffic coatings in rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
- B. Do not install traffic coating until items that penetrate membrane have been installed.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide primers; base-, intermediate-, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.2 TRAFFIC COATING

- A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, waterproofing membrane system with integral wearing surface for pedestrian traffic; according to ASTM C957.
 - 1. Products: One of the following:
 - a. BASF Building Systems; Sonneborn Sonoguard Light to Medium Duty Traffic and Pedestrian System.
 - b. Neogard, Div. of Jones-Blair; Peda-Gard II.
 - c. Tremco Incorporated; Vulkem 350/351.
- B. Primer: Liquid waterborne primer recommended for substrate and conditions by traffic-coating manufacturer.
 - 1. Material: Epoxy.
- C. Preparatory and Base Coats: Aliphatic polyurethane.
 - 1. Thicknesses: Minimum dry film thickness as recommended in writing by manufacturer for substrate and service conditions indicated.
- D. Intermediate Coat: Aliphatic polyurethane.
 - 1. Thicknesses: Minimum dry film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
 - 2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated.
- E. Topcoat: Aliphatic polyurethane.
 - 1. Thicknesses: Minimum dry film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured excluding aggregate.
 - 2. Aggregate Content: As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated.
 - 3. Color: As selected by Architect from manufacturer's full range.
- F. Aggregate: Manufacturer's standard aggregate for each use indicated of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.
- G. Joint Sealants: ASTM C920, Type S, Class 25, Grade NS, Use T. Suitable backer rod acceptable to sealant manufacturer.

- H. Sheet Flashing: Nonstaining sheet material recommended in writing by traffic-coating manufacturer.
 - 1. Thickness: Minimum 60 mils.
- I. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.
- J. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 - 1. Test for moisture according to ASTM D4263.
 - 2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. General: Before applying traffic coatings, clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

- C. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.
- D. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D4259. Do not acid etch.
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D4258.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C1127 and manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Comply with recommendations in ASTM C1193 for joint-sealant installation.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to ASTM C1127 and manufacturer's written instructions.

- B. Apply number of coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.
- D. Verify that wet film thickness of each coat complies with requirements every 100 sq. ft.
- E. Uniformly broadcast aggregate on coats specified to receive aggregate. Embed aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- G. Cure traffic coatings. Prevent contamination and damage during application and curing stages.

3.6 FIELD QUALITY CONTROL

- A. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Prepare test and inspection reports.

3.7 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071813

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Foam-plastic board insulation.
- 2. Glass-fiber blanket insulation.
- 3. Mineral-wool blanket insulation.
- 4. Sound attenuation batts.

- B. Related Requirements:

- 1. Section 092900 "Gypsum Board" for sound attenuation blankets in gypsum board assemblies.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 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 C578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
 - 1. Manufacturers: Provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning Insulating Systems, LLC.
 - 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.
- C. Exterior Walls R-Value: Compliant with International Building Code and International Energy Conservation Code.

2.2 GLASS-FIBER AND MINERAL FIBER BLANKET INSULATION

- A. Unfaced, Glass-Fiber or Mineral Fiber Batts: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics. Provide one of the following:
1. "Unfaced Precut Batts"; Guardian Fiberglass, Inc.
 2. "Unfaced Standard Density Batts"; Knauf Fiber Glass.
 3. "Thermal Batts"; Owens Corning Insulating Systems, LLC.
 4. "SAFB Insulation"; Fibrex Insulations, Inc.
 5. "Thermafiber FS-15 Blankets"; Thermafiber.
- B. Sound Attenuation Blankets: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics. Provide one of the following:
1. CertaPro AcoustaTherm Batt"; CertainTeed Corp.
 2. "Unfaced Batts"; Johns Manville.
 3. "Sound Attenuation Batts"; Owens Corning Insulating Systems, LLC.
 4. "SAFB Insulation"; Fibrex Insulations, Inc.
 5. "Thermafiber Sound Attenuation Fire Blankets"; Thermafiber.
- C. Exterior Walls R-Value: Compliant with Florid Building Code and Energy Conservation Code.

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Basis of Design Product: Thermafiber; FS-25.
- B. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.4 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation 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 rain 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. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward exterior of construction.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 PROTECTION

- A. Protect installed insulation 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.

END OF SECTION 072100

SECTION 072500 - WEATHER 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:

- 1. Building wrap.
- 2. Flexible flashing.

- B. Related Requirements:

- 1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

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

- 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.

- 1. Basis of Design Product: DuPont; Tyvek CommercialWrap. Other acceptable products:

- a. Fiberweb; MetroWrap Commercial Building Wrap.
 - b. Henry; Weathersmart Commercial Moisture Protection Barrier.
- 2. Water-Vapor Permeance: Not less than 20 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
 - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E2178.
 - 4. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
 - 1. Basis of Design Product: DuPont; DuPont Tyvek Self-Adhered Flashing. Other acceptable products:
 - a. GCP Applied Technologies; Vycor Self-Adhered Flashing.
 - b. Henry; Blueskin Butyl Flash Self-Adhered Flashing.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F1667.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.

2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 4. Lap water-resistive barrier over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 072500

SECTION 072600 - UNDERSLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes vapor retarder for installation under concrete slabs on grade.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: 12 inch sample of vapor retarder material.

1.3 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Stego Industries, LLC; Stego Wrap 15. Other acceptable products:
 - 1. Raven Industries, Inc.; Vapor Block 15.
 - 2. Reef Industries, Inc.; Griffolyn 15 Mil Green.

2.2 VAPOR RETARDER MATERIALS

- A. Vapor Retarder: Multilayer polyolefin sheet material complying with ASTM E1745, Class A. 15 mil thickness. Water vapor permeance less than 0.0254 perms according to ASTM F1249.
- B. Seam Tape: Stego's "Stego Tape." 0.3 perms or lower according to ASTM E96.
- C. Mastic: Stego's "Stego Mastic." 0.3 perms or lower according to ASTM E96.

- D. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.

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 work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions and ASTM E1643.
- B. Unroll vapor retarder with longest dimension parallel with direction of the concrete pour.
- C. Lap vapor retarder over footings or seal to foundation walls.
- D. Overlap joints 6 inches and seal with specified tape.
- E. Seal all penetrations according to manufacturer's written installation instructions.
- F. No penetration of vapor retarder allowed except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with specified tape.

END OF SECTION 072600

SECTION 072726 - 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.

1.3 PREINSTALLATION MEETINGS

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

1.4 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. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

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 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.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, 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 E283 or ASTM E783.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane.
 - 1. Products: Provide one of the following:
 - a. Synthetic Polymer Membrane:
 - 1) GCP Applied Technologies; Grace Perm-A-Barrier VP.
 - 2) Dryvit Systems, Inc.; Backstop NT.
 - 3) Sto Corporation; Sto Gold Coat.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.001 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Vapor Permeance: Minimum 7.0 perms; ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D412, 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. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- D. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- E. Flashing System: Liquid waterborne polymer flashing material and mesh for sealing openings at wall penetrations.
 - 1. Basis of Design Product: Dryvit Systems, Inc.; AquaFlash System.

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.

- 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.

3.3 TRANSITION STRIP INSTALLATION

- A. General: Install flashing system and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
- 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.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Wall Openings: Prime concealed, perimeter frame surfaces of windows, storefronts, and doors. Apply flashing system to achieve a minimum of 3 inches coverage over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
- E. Fill gaps in perimeter frame surfaces of windows, storefronts, and doors, and miscellaneous penetrations of air-barrier material as recommended by manufacturer.

3.4 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.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

- 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 equal coats.
- C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 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 072726

SECTION 073113 - ASPHALT SHINGLES

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. Asphalt shingles.
- 2. Underlayment.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood framing.
- 2. Structural Drawings for roof sheathing.

1.3 DEFINITION

- 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 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For the following products, of sizes indicated, to verify color selected:
 - 1. Asphalt Shingle: Full size.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

- C. Research/Evaluation Reports: For each type of asphalt shingle required, from the ICC.
- D. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of asphalt shingle to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft of each type, in unbroken bundles.

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. Source Limitations: Obtain ridge and hip cap shingles [ridge vents] [felt underlayment] [and] [self-adhering sheet underlayment] from single source from single manufacturer.
- C. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- D. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
 1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install asphalt shingles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. Structural failures including failure of asphalt shingles to self-seal after a reasonable time.
 - 2. Material Warranty Period: 25 years from date of Substantial Completion, prorated, with first five years nonprorated.
 - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds indicated on Drawings for five years from date of Substantial Completion.
 - 4. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 10 years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: 10 years from date of Substantial Completion.
- B. Special Project Warranty: Roofing Installer's Warranty, signed by roofing Installer, covering the Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D 3161/D 3161M, Class F, and with ASTM D 7158/D 7158M, Class H.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Multitab-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Basis of Design: Owens Corning Roofing and Asphalt, LLC; Supreme Shingles. A comparable product by one of the following manufacturers also acceptable:
 - a. Atlas Roofing Corporation.
 - b. CertainTeed Corporation.
 - c. GAF Materials Corporation.
 - d. IKO.
 - e. TAMKO Roofing Products, Inc.
 - 2. Tab Arrangement: Three tabs, regularly spaced.
 - 3. Cutout Shape: Square.
 - 4. Butt Edge: Straight cut.
 - 5. Strip Size: Manufacturer's standard.
 - 6. Algae Resistance: Granules treated to resist algae discoloration.
 - 7. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 55-mil thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. Provide one of the following:
 - 1. GCP Applied Technologies; GRACE Ice & Water Shield HT.
 - 2. Henry; Blueskin Roof Ice and Water Barrier/High Temp.
 - 3. Owens Corning Roofing and Asphalt, LLC; Titanium PSU30.

2.5 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, low-profile ridge vent with built-in weather baffle. 10 foot lengths. Prepunched nail holes for securement to roof deck substrates.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Air Vent, Inc.
 - b. Cor-A-Vent, Inc.
 - c. GAF Materials Corporation.
 - d. Lomanco.
 - e. Owens Corning.
 - 2. Minimum Net Free Area: 21.5 sq. in. per lineal foot.
 - 3. Aluminum Sheet Thickness: 0.025 inch.
 - 4. Color: As selected by Architect from manufacturer's full range.

2.6 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586, Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through plywood sheathing.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Valley Flashing: 60 inch wide peel-and-stick EPDM membrane by Firestone Building Products or acceptable equivalent.

2.7 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Prefinished aluminum.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.

1. Drip Edges: Fabricate in lengths not exceeding 10 feet with minimum 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

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.
1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- 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 UNDERLAYMENT INSTALLATION

- A. General: Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water.
 - a. Lap sides not less than 4 inches.
 - b. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.

c. Roll laps with roller.

3. Eaves: Extend from edges of eaves 24 inches beyond interior face of exterior wall.
4. Rakes: Extend from edges of rakes 24 inches beyond interior face of exterior wall.
5. Valleys: Extend from lowest to highest point 18 inches on each side of centerline.
6. Hips: Extend 18 inches on each side.
7. Ridges: Extend 36 inches on each side without obstructing continuous ridge vent slot.
8. Roof-Penetrating Elements: Extend 18 inches beyond penetrating elements and return vertically against penetrating elements not less than 4 inches.
9. Roof-Slope Transitions: Extend 18 inches on each roof slope.
10. Cover underlayment within seven days.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
 2. Bed flanges of metal flashings, using asphalt roofing cement or elastomeric flashing sealant.
- B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
- D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed, unless recommended by manufacturer, with self-sealing strip face up at roof edge.
 1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.
 2. Install starter strip along rake edge.

- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- E. Fasten asphalt shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.
 - 1. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
 - 2. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- F. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
 - 1. Do not nail asphalt shingles within 6 inches of valley center.
 - 2. Set trimmed, concealed-corner asphalt shingles in a 3-inch wide bed of asphalt roofing cement.
- G. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- H. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 073113

SECTION 074646 - FIBER-CEMENT SIDING

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 fiber-cement siding and soffit, and decorative trim elements indicated on Drawings.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers and blocking.

1.3 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch long-by-actual-width Sample of siding.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement siding and soffit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of fiber-cement siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for fiber-cement siding including accessories.
 - a. Size: 48 inches long by 60 inches high.
 - b. Include outside corner on one end of mockup.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
- B. Lap Siding:
 - 1. Basis of Design Product: James Hardie Building Products, Inc.; HardiePlank Lap Siding.
 - 2. Horizontal Pattern: Boards 7-1/4 inches wide with 6 inch exposure wide in plain style with smooth texture. 5/16 inch material thickness.
- C. Board and Batten Panel Siding:
 - 1. Basis of Design Product: James Hardie Building Products, Inc.; HardiePanel and HardieTrim.
 - 2. Vertical Pattern: Boards in 5/16 inch material thickness. Smooth texture.
 - 3. Batten Strips: 3/4 inch by 2-1/2 inch strips.
- D. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- E. Panel Siding: Panel size and orientation as indicated on Drawings. Color and finish as scheduled or selected from manufacturer's full range.
- F. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER-CEMENT SOFFIT

- A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
 - 1. Basis of Design Product, Soffit: James Hardie Building Products; HardieSoffit.
- B. Match panel siding. Panel size and orientation as indicated on Drawings.
- C. Ventilation: Provide manufacturer's standard perforated soffit unless otherwise indicated.
- D. Factory Priming: Manufacturer's standard acrylic primer.

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
 - 2. Basis of Design, Trim Components: James Hardie Building Products, Inc.; HardieTrim Boards, 4/4 Smooth.
 - a. Nominal Thickness: 0.75 inch.
 - b. Width: 5-1/2 inches.
 - c. Exposure: 5-1/2 inches.
 - d. Board Lengths: 144 inches.
- B. Decorative Accessories: Provide fiber-cement decorative accessories as indicated.
- C. Flashing: Provide aluminum flashing at window and door heads and where indicated. Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles unless otherwise indicated on Drawings.
 - 1. Aluminum Sheet: ASTM B209 alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required, with smooth, flat surface. 0.032 inch material thickness.
 - 2. Aluminum Finish: Siliconized polyester coating.

D. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
3. For fastening fiber cement, use stainless-steel fasteners.
4. Finish: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Do not install damaged components.
 2. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation. Comply with manufacturer's limitations for acceptable joint sealant applications.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 076200 - 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 roof-drainage sheet metal fabrications.
- 2. Formed low-slope roof sheet metal fabrications.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details. Detail fabrication and installation layouts. Identify materials, thicknesses, weights, and finishes. Minimum scale for details not less than inches per 12 inches.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: 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.

1.8 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies 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. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - 2. Exposed Coil-Coated Finish, Gutters and Downspouts:
 - a. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
 - 3. Color: As indicated on Drawings.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 2D (dull, cold rolled).

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - 1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, 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 C920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D1187.

- G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in 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 to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners 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 indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- 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 cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- H. Do not use graphite pencils to mark metal surfaces.

2.5 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
5. Gutter Profile: As indicated on Drawings.
6. Expansion Joints: Lap type.
7. Gutters: Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

B. Downspouts: Fabricate downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Hanger Style: As indicated on Drawings.
2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.

B. Counterflashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

C. Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.019 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, 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, levels, and slopes. 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. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. 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 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 079200 "Joint Sealants."

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
 - 1. Join sections with joints sealed with sealant.
 - 2. Provide for thermal expansion.
 - 3. Attach gutters at eave or fascia to firmly anchor them in position.
 - 4. Provide end closures and seal watertight with sealant.
 - 5. Slope to downspouts.
 - 6. Fasten gutter spacers to front and back of gutter.
 - 7. Anchor and back of gutter as detailed on Drawings.
 - 8. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
 - 9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. 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 minimum of 4 inches. Secure in waterproof manner by means as indicated on Drawings.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

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 indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

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 sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in 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 076200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has 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 penetration firestopping.

1.5 QUALITY ASSURANCE

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

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide products by one of the following:

1. A/D Fire Protection Systems Inc.
2. GCP Applied Technologies.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 CLEANING AND PROTECTION

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

3.6 PENETRATION FIRESTOPPING SCHEDULE

- A. Refer to Drawings for penetration firestopping schedule.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Solvent-release joint sealants.

- B. Related Requirements:

1. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants.
2. Section 088000 "Glazing" for glazing sealants.
3. Section 092900 "Gypsum Board" for sealing perimeter joints.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- C. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

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

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: 10 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 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C920 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.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT. For vertical joints.
 1. Products: Provide one of the following the products:
 - a. The Dow Chemical Company; DOWSIL 791 Weatherproofing Sealant or DOWSIL 795 Silicone Building Sealant.
 - b. GE Advanced Materials - Silicones; SilPruf NB SCS9000, SilPruf SCS2000 or UltraPruf II SCS2900.

- c. Pecora Corporation; 895 or 898.
- d. Sika Corporation, Construction Products Division; SikaSil-C995.
- e. Tremco Incorporated; Spectrem 2 or Spectrem 3.

B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Provide one of the following products:

- a. The Dow Chemical Company; DOWSIL 786 Silicone Sealant.
- b. GE Advanced Materials - Silicones; Sanitary SCS1700.
- c. Pecora Corporation; 898.
- d. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920. Type S, Grade NS, Class 25, for Use T.

1. Products: Provide one of the following products:

- a. Sika Corporation, Construction Products Division; Sikaflex - 1a.
- b. Tremco Incorporated; Vulkem 116.

B. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

1. Products: Provide one of the following products:

- a. Pecora Corporation; Dynatred.
- b. Tremco Incorporated; Vulkem 227.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Provide one of the following products:

- a. Pecora Corporation; AC-20+.
- b. Tremco Incorporated; Tremflex 834.

2.5 SOLVENT-RELEASE-CURING JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealant: ASTM C1311.
 - 1. Products: Provide one of the following products:
 - a. Pecora Corporation; BC-158.
 - b. Tremco Incorporated; Tremco Butyl Sealant.

2.6 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 C1330, 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.

2.7 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.
 - 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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C1193, unless otherwise indicated.

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.
 - b. Other joints as indicated.
 - 2. Urethane Joint Sealant: One of the specified urethane traffic grade sealants and to suit installation conditions.
 - 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. Control and expansion joints in unit masonry.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Other joints as indicated.
 - 2. Silicone Joint Sealant: The specified vertical joint silicone sealant and to suit installation conditions.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- C. 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. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - e. Other joints as indicated.
 2. Joint Sealant: Latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. 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.
 - c. Other joints as indicated.
 2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL 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 acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Acoustical-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.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Accumetric LLC.
 - b. Grabber Construction Products.
 - c. Pecora Corporation.
 - d. Specified Technologies, Inc.
 - e. Tremco Incorporated.
 - f. United States Gypsum Co.
 - 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

- 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 acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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 ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

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 acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

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

END OF SECTION 079219

SECTION 079513 - EXTERIOR EXPANSION JOINT COVER 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 exterior building expansion joint cover assemblies.

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 expansion joint cover assemblies.
 - 2. Include information evidencing compliance with performance requirements.
- B. Shop Drawings: For each expansion joint cover assembly.
 - 1. Include plans, elevations, sections, details, splices, attachments to other work, and line diagrams showing entire route of each expansion joint.
 - 2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.
- D. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion joint cover assembly.
 - 2. Expansion joint cover assembly location cross-referenced to Drawings.
 - 3. Nominal, minimum, and maximum joint width.
 - 4. Movement direction.
 - 5. Materials, colors, and finishes.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct a conference at Project site prior to commencement of exterior expansion joint installation pursuant to requirements in Section 01040 "Project Coordination."
 - 1. Review materials, installation procedures, schedules, and other requirements.
 - 2. Required Attendees: Installer, manufacturer's representative, Design Build team, Owner, and all subcontractors whose work interfaces with exterior expansion joint covers.

1.5 WARRANTIES

- A. Special Watertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace exterior expansion joint cover assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Installer Warranty: Installer's written warranty against failures in materials and workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Expansion Joint Design Criteria:
 - 1. Type of Movement: Seismic.
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Joint Movement: As indicated on Structural Drawings.

2.2 EXTERIOR EXPANSION JOINT COVERS

- A. Exterior Expanding Tape Seals: Factory-applied low-modulus silicone bellow weather facing with open-cell polyurethane foam infused with a water-based, non-drying acrylic dispersion. Integral mounting adhesive. Color silicone facing. Tape seals 100 percent free of wax and asphaltic compounds. For nonrated joints and floor/wall/ceiling applications.
 - 1. Basis of Design Product: Emseal Joint Systems, Ltd.; Seismic ColorSeal.

2. Other Acceptable Manufacturers:
 - a. Construction Specialties, Inc.
 - b. MM Systems Corporation.
 - c. Watson Bowman Acme Corp.

2.3 ACCESSORIES

- A. Manufacturer's standard accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish instructions for installing expansion joint cover assemblies.

3.3 INSTALLATION

- A. General: Install exterior expansion joint cover assemblies according to manufacturer's written installation instructions and approved shop drawings.
 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 3. Install in continuous contact with adjacent surfaces.
- B. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

- C. Terminate exposed ends of expansion joint cover assemblies pursuant to manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect exterior expansion joint cover assembly installation, including accessories. Report results in writing. Reports are required for interim inspections and final inspection.

3.5 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION 079513.16

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 COORDINATION

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

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

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

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and windborne-debris impact resistance door, and thermally rated door assemblies for tests performed by a qualified testing agency.

1.8 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. Acceptable Manufacturers: Provide hollow metal doors and frames by one of the following manufacturers:
1. Ceco Door Products.
 2. Curries Company.
 3. Fleming Door Products Ltd.
 4. Gensteel Doors Inc.
 5. Republic Doors and Frames.
 6. Steelcraft.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE 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 and temperature-rise limits 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.
 2. Temperature-Rise Limit: Where indicated on Drawings, 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.
- B. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Project Wind Zone for basic protection.
1. Large-Missile Test: For glazed openings located within 30 feet of grade.

2.3 INTERIOR DOORS AND FRAMES

- A. Basis of Design, Interior Doors with Full Glass Lites: Steelcraft; L Series.
- B. Adjustable Door Frames: Timely Prefinished Steel Door Frames; Adjustable Kerfed :Frame.

- C. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- D. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - 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 mineral-board core.
 - 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Full profile welded.
 - c. Basis of Design: Steelcraft; F, FN, C, DW, K and CK Series.
 - d. Applications: Trash Rooms, Stairwells, Storage Rooms, MEP, MDF/IDF, Bike Storage Rooms, all Back-of-The-House areas.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Basis of Design Manufacturer: Fleming Door Products Ltd.
- B. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- C. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 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 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Polyurethane.
 - 1) Thermal-Rated Doors: Provide doors fabricated with minimum thermal-resistance value (R-value) of not less than 13.0.

3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.5 UNIT ENTRY FLUSH DOORS

- A. Basis of Design: Steelcraft; 1-3/4" HD Metal Edge High Definition Steel Entrance Door.
 1. 24 gage hot-dip galvanized steel door sheets, primed. 22 gage primed split adjustable metal frames fabricated for 36 inch wide by 80 inch high doors.
 2. Polyurethane foam inner core.
 3. Solid wood stile and rail with composite bottom rail.
 4. Solid wood lock block prepped for lockset and hinges. Other preparation as necessary for door hardware and access control.
 5. Rated Doors: 20 minute rated doors unless otherwise indicated or required by governing Code.

2.6 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.
- 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.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- 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 C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.
- H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
 - 1. Glazing, Stair Doors: Provide for all interior stair doors. 1/4 inch clear ceramic glass for required fire rating. Provide Steelcraft NR Light or comparable product. 4 inch wide by 25 inch high glass lites. Exception: No glazing for stair doors leading to building exterior.
- 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.

2.8 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. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.

3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 5. 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.
 6. 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 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) Three anchors per jamb from 60 to 90 inches high.
 - 2) Four anchors per jamb from 90 to 120 inches high.
 - 3) 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) Four anchors per jamb from 60 to 90 inches high.
 - 2) Five anchors per jamb from 90 to 96 inches high.
 - 3) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 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.
- 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.

2.9 STEEL FINISHES

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

2.10 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. 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. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. 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.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, 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 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches 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. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Hollow-core paneled wood doors for opaque finish.
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

1. Section 099110 "Painting" for field finishing hollow-core doors.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.

2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.
6. Requirements for veneer matching.
7. Doors to be factory finished and application requirements.
8. Fire-protection ratings for fire-rated doors.
9. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.8 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 top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD 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 temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. 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.
 - 4. Warranty Period for Hollow-Core Interior Doors: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
- B. 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. 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.
 - 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 4. 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.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-1.
 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- E. 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.
- 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.
- 2.2 FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH
- A. Interior Doors:
1. Manufacturers: Provide products by the following:
 - a. Eggers Industries.
 - b. Lambton Doors.
 - c. Mohawk Doors.
 - d. Masonite International.
 - e. VT Industries.

2. Architectural Woodwork Standards Grade: Premium.
3. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: Natural birch.
 - b. Cut: Plain sliced.
 - c. Match between Veneer Leaves: Match Architect's samples.
 - d. Assembly of Veneer Leaves on Door Faces: Balance match.
4. Exposed Vertical and Top Edges: Same species as faces.
5. Core for Non-Fire-Rated Doors: ANSI A208.1, Grade LD-1 particleboard.
 - a. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
6. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.3 HOLLOW-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Hollow Core:

1. Basis of Design Manufacturer: Jeld-Wen or comparable manufacturer.
2. Performance Grade: WDMA ANSI/I.S. 1A Standard Duty.
3. ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Any closed-grain hardwood of mill option.
5. Exposed Vertical Edges: Any closed-grain hardwood.
6. Construction: Standard hollow core.
7. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. 5-by-18-inch lock blocks.
 - c. 5-inch top-rail blocking.
 - d. 10-inch bottom-rail blocking.
 - e. 2-1/2-inch midrail blocking.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

- 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.
- C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors indicated on Drawings to receive transparent finish.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Premium.
 - 2. Finish: Architectural Woodwork Standards System-12, Water-Based Polyurethane.
 - 3. Staining: Match Architect's sample.

4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
1. Install fire-rated doors according to NFPA 80.
 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. 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 081416

SECTION 081433 - STILE AND RAIL 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. Interior stile and rail wood doors.
2. Fitting stile and rail wood doors to frames and machining for hardware.
3. Prehanging doors in frames.

- B. Related Requirements:

1. Section 099110 "Painting" for field finishing stile and rail doors.

1.3 ACTION SUBMITTALS

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

1. Include details of construction.

- B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of door, from manufacturer.

- B. Sample Warranty: For special warranty.

- C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD 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 remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, within specified warranty period.
 - 1. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Interior Doors: Five years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Use only materials that comply with referenced standards and other requirements specified.
 - 1. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
- B. Panel Products: Utilize the following:
 - 1. Hardboard complying with ANSI A135.4.
 - 2. Veneer-core plywood.

2.2 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior doors complying with WDMA I.S.6, "Industry Standard for Wood Stile and Rail Doors," and with other requirements specified.
1. Basis-of-Design Manufacturer: Jeld-Wen or comparable manufacturer.
 2. Panel Design: As indicated on Drawings.
 3. Finish and Grade: Opaque and Standard.
 4. Wood Species: Manufacturer's standard softwood species and cut.
 5. Stile and Rail Construction: Manufacturer's standard.
 6. Raised-Panel Construction: Hardboard.
 7. Flat-Panel Construction: Hardboard.
 8. Raised-Panel Thickness: Manufacturer's standard.
 9. Flat-Panel Thickness: Manufacturer's standard.
 10. Core Construction: Hollow core with corrugated hardboard honeycomb.

2.3 WOOD DOOR FRAMES

- A. Interior Frames:
1. Wood Species and Cut: Match species and cut indicated for wood doors.
 2. Wood Moisture Content: 8 to 13 percent.
 3. Profile: As indicated on Drawings.

2.4 STILE AND RAIL WOOD DOOR FABRICATION

- A. Fabricate stile and rail wood doors in sizes indicated for field fitting.
- B. Prehung Doors: Provide stile and rail doors complete with frames and hardware.
1. Provide hardware that complies with Section 087100 "Door Hardware."

2.5 FACTORY PRIMING

- A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099100 "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

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. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/4 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated or recommended by manufacturer. Where threshold is shown or scheduled, provide 3/8 inch from bottom of door to top of threshold unless otherwise indicated.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

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 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 081433

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames for walls and ceilings.
 - 2. Fire-rated access doors and frames.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Provide products by one of the following:
 - 1. Acudor Products, Inc.
 - 2. J. L. Industries, Inc.
 - 3. Larsen's Manufacturing Company.

4. Milcor Inc.
5. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: As indicated.
3. Door Size: As indicated.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Lock.

D. 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: As indicated.
3. Door Size: As indicated.
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.

2.2 MATERIALS

- A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- B. Frame Anchors: Same type as door face.
- C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish 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. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.
 - 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.4 FINISHES

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

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 083113

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes electrically operated raised panel sectional doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

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

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E 330.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
- C. Windborne-Debris Impact Resistance: Provide sectional doors that pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for Project Wind Zone.
 - 1. Large Missile Test: For overhead coiling doors located within 30 feet of grade.

2.3 SECTIONAL DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Basis of Design: C.H.I. Overhead Doors; Model 2251. A comparable product by one of the following manufacturers is also acceptable:
 - a. Clopay Building Products.
 - b. Overhead Door Corporation.
 - c. Raynor.
 - d. Wayne-Dalton Corp.
 - e. Windsor Door.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Installed R-Value: Minimum 17.94 deg F x h x sq. ft./Btu.

- D. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
1. Door-Section Thickness: 2 inches.
 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: 0.028-inch nominal coated thickness.
 - 2) Surface: Manufacturer's standard, paneled.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of dimension recommended in writing by manufacturer to comply with performance requirements.
 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
 4. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard insulation of type indicated below:
 - a. Board Insulation: Polystyrene, secured to exterior face sheet.
 - b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- E. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.

- a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door.
- G. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
- 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch (2.01-mm) nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Manufacturer's standard.
 - 3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
- H. Counterbalance Mechanism:
- 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
 - 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
 - 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 - 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- I. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 1. Basis of Design: Liftmaster; 6155W.
 2. Comply with NFPA 70.
 3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 4. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
 5. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 6. Operator Type: Manufacturer's standard for door requirements.
 7. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: As required 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.
 - b. Electrical Characteristics:
 - 1) Phase: Polyphase.
 - 2) Volts: 208 V.
 8. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 9. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 10. Control Station: Flush mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

- c. Features: Provide the following:
 - 1) Radio-control operation.
 - 2) Audible and visual signals that comply with regulatory requirements for accessibility.
 - 11. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
 - 12. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 - 13. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- J. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- 1. 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. Color as selected by Architect from manufacturer's full range.
 - 2. Finish of Interior Facing Material: Match finish of exterior section face.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

3.5 DEMONSTRATION

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

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.
 - 2. Aluminum-framed entrance door systems.
- B. Related Requirements:

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Florida, responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 - 1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by qualified testing agency.
- B. Field Quality-Control Submittals:
 - 1. Field quality-control reports.
- C. Delegated design engineer qualifications.
- D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
 - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in [state] <Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
 - 3. Testing Agency: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans of up to 13 feet 6 inches and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 2. When tested at 150% percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-

pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

- G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
 - 2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 STOREFRONT SYSTEMS

- A. Basis of Design Products: Kawneer Company, Inc.; Trifab VG451T (exterior) and Trifab 400 (interior). Products by YKK America AP also acceptable.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Interior Framing Construction: Nonthermal.
 - 3. Glazing System: Retained mechanically with gaskets on four sides.
 - 4. Glazing Plane: Front.
 - 5. Finish: Clear anodic finish.
 - 6. Fabrication Method: Field-fabricated stick system.
 - 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 8. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS

- A. Basis of Design Products: Kawneer Company, Inc.; 350T Thermal Entrance (exterior) and 350 Standard Entrance (interior). Products by YKK America AP also acceptable.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic 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.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: Medium stile; 3-1/2-inch nominal width.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 - 4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. 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. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 - 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to 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.
- C. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- D. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- F. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.7 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.8 ACCESSORIES

- A. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. 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.

- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests prior to completion.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes vinyl-framed windows.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review, discuss, and coordinate the interrelationship of vinyl windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
- D. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of vinyl window, for tests performed by a qualified testing agency.

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

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
- b. Structural failures including excessive deflection, water leakage, and air infiltration.
- c. Faulty operation of movable sash and hardware.
- d. Deterioration of materials and finishes beyond normal weathering.
- e. Failure of laminated glass.

- 2. Warranty Period:

- a. Window: 10 years from date of Substantial Completion.
- b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain vinyl windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

- 1. Single-Hung Window Unit Performance: H-R25 (DP+40/-40). Non-thermal.
- 2. Fixed Window Unit Performance: FW-LC55 (DP+55/-55). Non-thermal.

- C. Wind Loads: Design pressure based on Project wind speed.

- D. Air Infiltration: Tested according to ASTM E283.
- E. Water Penetration: Tested according to ASTM E331.
- F. Impact Resistance: Tested according to AAMA 506.

2.3 VINYL WINDOWS

- A. Basis of Design Product: PlyGem Windows; 1500 Series. Other acceptable manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Doers Window Manufacturing.
 - 3. Jeld-Wen.
 - 4. Weather Shield Mfg., Inc.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Single hung.
 - 2. Fixed.
- C. Frames: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. Exterior Finish: Integral color as selected by Architect.
 - 2. Interior Finish: White.
 - 3. Gypsum Board Returns: Provide at interior face of frame.
- D. Glazing System: Manufacturer's standard factory-glazing insulating laminated glass units with Low-E coated outboard lites and clear inboard laminated glass lites.
 - 1. Performance Values, Single-Hung Window Units: SHGC 0.26.
 - 2. Performance Values, Fixed Window Units: SHGC 0.28.
- E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

- F. Hung Window Hardware:
 - 1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 - 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
 - 3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 FABRICATION

- A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze vinyl windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units. Provide manufacturer's standard finish to match window units.
- E. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 CLEANING AND PROTECTION

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

END OF SECTION 085313

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

- B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

- C. Related Sections:

1. Division 08 Section "Door Schedule".
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
4. Division 28 Section "Access Control Hardware Devices".

- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 3. ANSI/UL 294 - Access Control System Units.
 4. UL 305 - Panic Hardware.
 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction

schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door

Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in

hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

- a. Hager Companies (HA) - BB Series, 5 knuckle.
- b. McKinney (MK) - TA/T4A Series, 5 knuckle.
- c. dormakaba Best (ST) - F/FBB Series, 5 knuckle.

B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
- b. Pemko (PE).

C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.

2. Manufacturers:

- a. Hager Companies (HA).
- b. Johnson Hardware (JO).
- c. Pemko (PE).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko (PE) - EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.
- c. Von Duprin (VD) - EPT-10 Series.

- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.
 2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney (MK) - QC-C Series.
 - c. Dormakaba Best (ST) - WH Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 1. Manufacturers:
 - a. Yale Commercial (YA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:
 - a. Yale Commercial (YA) - 8800FL Series.

B. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 Certified Products Directory (CPD) listed. Locks are to be non-handed and fully field reversible.

1. Manufacturers:
 - a. Yale Commercial (YA) - 4600LN Series.

C. Residential Tubular Locking Devices: Standard ANSI A156.2, Series 4000, Grade 2.

1. Tubular locksets, deadbolts, and handlesets designed to fit ANSI standard door preps.
2. Locks are to be non-handed and have adjustable backset.

3. Manufacturers:
 - a. Yale Residential (YR) - YH Series.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed, subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below and in the hardware sets.
 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML20900 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Yale Commercial (YA) - 8800FL Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 12. Hurricane and Tornado Resistance Compliance: Conventional exit devices are to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.
1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.
 2. Manufacturers:
 - a. Yale (YA) - 7050 Series.
- C. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.
1. Manufacturers:
 - a. Yale Commercial (YA) - 6000 Series.

2.10 ELECTROMECHANICAL EXIT DEVICES

- A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.
1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Yale (YA) - 7000 Series.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 25-year warranty.

2. Manufacturers:

- a. Corbin Russwin Hardware (RU) - DC6000 Series.
- b. Norton Rixson (NO) - 7500 Series.
- c. Sargent Manufacturing (SA) - 351 Series.
- d. Yale Commercial (YA) - 4400 Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - DC6000 Series.
- b. Norton Rixson (NO) - 8500 Series.
- c. Sargent Manufacturing (SA) - 1431 Series.
- d. Yale Commercial (YA) - 3500 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.15 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Securitron (SU) - DPS Series.
- B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected,

continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:
 - a. Securitron (SU) - AQL Series.

2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted

items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. MR - Markar
3. PE - Pemko
4. SU - Securitron
5. RO - Rockwood
6. YA - Yale
7. YR - Yale Residential
8. RF - Rixson
9. MC - Medeco
10. OT - Other

Hardware Sets

Set: 00.04.77.CRRM

Description: EXT. ALUM EXIT - CR

1	Continuous Hinge	FM300 CTP - DOOR HEIGHT	630	MR	087100
1	Electric Power Transfer	EL-CEPT		SU	087100
1	Rim Exit Device, Nightlatch	7150 WS B MELR 121NL Temp Core	630	YA	087100
1	Core	A600	626	YA	087100
1	Door Pull	RM3310-36 Mtg-Type 1XHD	US32D	RO	087100
1	Surface Closer	4430	689	YA	087100

1	Threshold	2005AT	PE	087100
1	Rain Guard	346C	PE	087100
1	Sweep (w/ drip edge)	3452CNB	PE	087100
1	Updater/Controller	NTX6xx-KIT-xx	YA	281500
1	Frame Harness	QC-C1500P	MK	087100
1	Door Harness	QC-CXXX- LENGTH TO SUIT	MK	087100
1	Card Reader	Provided By Security Supplier	OT	
1	Door Position Switch	DPS2-M/W-BK (TO SUIT)	SU	087100
1	Power Supply	AQLxx-R8E1	SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:

- Perimeter/meeting stile seals by frame/door supplier.
- Electronic Operation: Valid card or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.
- All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 10.04.73.1CRRM

Description: EXT. HM EXIT - CR

1	Continuous Hinge	FM300 CTP - DOOR HEIGHT	630	MR	087100
1	Electric Power Transfer	EL-CEPT		SU	087100
1	Rim Exit Device, Nightlatch	7150 WS B MELR 121NL Temp Core	630	YA	087100
1	Core	A600	626	YA	087100
1	Pull	RM201 Mtg-Type 1XHD	US32D	RO	087100
1	Surface Closer	4430	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Threshold	2005AT		PE	087100
1	Rain Guard	346C		PE	087100
1	Gasketing (Head/Jambs)	S773BL		PE	087100
1	Sweep (w/ drip edge)	3452CNB		PE	087100
1	Updater/Controller	NTX6xx-KIT-xx		YA	281500
1	Frame Harness	QC-C1500P		MK	087100
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK	087100

1 Card Reader	Provided By Security Supplier	OT
1 Position Switch	DPS-M/W-BK (TO SUIT)	SU 087100
1 Power Supply	AQL4-R8E1	SU 087100
1 Wiring Diagram	Elevation and Point to Point as Specified	

Notes:

- Electronic Operation: Valid card or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.
- All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 15.04.73.1RM

Description: EXT. HM EXIT

1 Continuous Hinge	FM300 - DOOR HEIGHT	630	MR 087100
1 Rim Exit Device, Nightlatch	7150 WS 121NL Temp Core	630	YA 087100
1 Core	A600	626	YA 087100
1 Pull	RM201 Mtg-Type 1XHD	US32D	RO 087100
1 Surface Closer	4430	689	YA 087100
1 Kick Plate	K1050 10" CSK	US32D	RO 087100
1 Threshold	2005AT		PE 087100
1 Rain Guard	346C		PE 087100
1 Gasketing (Head/Jambs)	S773BL		PE 087100
1 Sweep (w/ drip edge)	3452CNB		PE 087100
1 Position Switch	DPS-M/W-BK (TO SUIT)		SU 087100

Notes:

- All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 20.71.73.1CR

Description: EXT. ELEC LOCK

1 Continuous Hinge	FM300 CTP - DOOR HEIGHT	630	MR 087100
1 Electric Power Transfer	EL-CEPT		SU 087100
1 Fail Safe Lock	MOCN 8896FL Temp Core REX	630	YA 087100

1	Core	A600	626	YA	087100
1	Surface Closer	4430	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Threshold	2005AT		PE	087100
1	Rain Guard	346C		PE	087100
1	Gasketing (Head/Jambs)	S773BL		PE	087100
1	Sweep (w/ drip edge)	3452CNB		PE	087100
1	Updater/Controller	NTX6xx-KIT-xx		YA	281500
1	Frame Harness	QC-C1500P		MK	087100
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK	087100
1	Card Reader	Provided By Security Supplier		OT	
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU	087100
1	Power Supply	AQLxx-R8E1		SU	087100
1	Wiring Diagram	Elevation and Point to Point as Specified			

Notes:

- Electronic Operation: Valid card unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.
- All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 25.04.73.1

Description: EXT. STR LOCK

1	Continuous Hinge	FM300 - DOOR HEIGHT	630	MR	087100
1	Storeroom Lock	MOCN 8840FL Temp Core	626	YA	087100
1	Core	A600	626	YA	087100
1	Surface Closer	4430	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Threshold	2005AT		PE	087100
1	Rain Guard	346C		PE	087100
1	Gasketing (Head/Jambs)	S773BL		PE	087100
1	Sweep (w/ drip edge)	3452CNB		PE	087100
1	Position Switch	DPS-M/W-BK (TO SUIT)		SU	087100

Notes:

- All exterior doors on this project shall meet FBC standards for windstorm. The door hardware specified is listed as a basis of design. If alternate hardware is proposed, please provide third-party test results and compliance information to architect.

Set: 30.04.77.ACC

Description: INT. ALUM - ACC EXIT

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Rim Exit Device	6100ED	630	YA	087100
1	Exit Device Trim	MO-NTT622-ACC	626	YA	281500
1	Mortise Cylinder	2153	630	YA	087100
1	Conc Overhead Stop	6-X36	630	RF	087100
1	Surface Closer	TJ3501	689	YA	087100
1	Drop Plate	3148/3547 (As Required)	689	YA	087100
1	Door Position Switch	DPS2-M/W-BK (TO SUIT)		SU	087100

Notes:

- Perimeter/meeting stile seals by frame/door supplier.
- Operational Description: Door is normally closed and locked. Presenting a valid credential to the reader on the exit device trim will momentarily unlock lever allowing entry. Entry also by key in cylinder. Manual egress at all times by pressing rail of exit device and exiting.

Set: 45.15.70

Description: INT. EXIT PASSAGE -RATED

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Fire Rated Rim Exit, Passage	6100FED MO628F	630	YA	087100
1	Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
1	Gasketing (Head/Jambs)	S88BL		PE	087100

Notes:

Set: 50.04.60.ACC

Description: INT. ACC LOCK

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Access Control Cyl Lock	MO NTB622-ACC LC	626	YA	281500
1	Core	A600	626	YA	087100
1	Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
3	Silencer	608/609 (TO SUIT)		RO	087100
1	Door Position Switch	DPS2-M/W-BK (TO SUIT)		SU	087100

Notes:

- Electronic Operation: Door is normally closed and locked. Door is normally closed and locked. Entering a valid code into the keypad will momentarily unlock outside lever, allowing entry. Entry also by key in cylinder. Egress at all times by operating inside lever and exiting.

Set: 55.04.32

Description: INT. PAIR - STR - RATED

6	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Dust Proof Strike	570	US26D	RO	087100
2	Flush Bolt (Manual)	555/557 (TO SUIT)	US26D	RO	087100
1	Storeroom Lock	MO 4605LN Temp Core	626	YA	087100
1	Core	A600	626	YA	087100
1	Surf Overhead Stop	10-X36	630	RF	087100
1	Surface Closer	3531	689	YA	087100
2	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Gasketing (Head/Jambs)	S88BL		PE	087100
1	Astragal (Overlapping)	357SP		PE	087100
1	Astragal (Meeting Edge)	S771C		PE	087100

Set: 55.04.60

Description: INT. STR

1	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Storeroom Lock	MO 4605LN Temp Core	626	YA	087100
1	Core	A600	626	YA	087100
1	Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100

1 Kick Plate	K1050 10" CSK	US32D	RO	087100
1 Door Stop	403/441CU (TO SUIT)	US26D	RO	087100

Set: 55.04.70

Description: INT. STR - RATED

1 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Storeroom Lock	MO 4605LN Temp Core	626	YA	087100
1 Core	A600	626	YA	087100
1 Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100
1 Kick Plate	K1050 10" CSK	US32D	RO	087100
1 Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
1 Gasketing (Head/Jambs)	S88BL		PE	087100

Set: 55.04.70.ACC

Description: INT. ACC LOCK - RATED

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Access Control Cyl Lock	MO NTB622-ACC LC	626	YA	281500
1 Core	A600	626	YA	087100
1 Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100
1 Kick Plate	K1050 10" CSK	US32D	RO	087100
1 Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
1 Gasketing (Head/Jambs)	S88BL		PE	087100
1 Door Position Switch	DPS2-M/W-BK (TO SUIT)		SU	087100

Notes:

- Electronic Operation: Door is normally closed and locked. Door is normally closed and locked. Entering a valid code into the keypad will momentarily unlock outside lever, allowing entry. Entry also by key in cylinder. Egress at all times by operating inside lever and exiting.

Set: 55.05.50

Description: INT. OFFICE

3 Hinge, Full Mortise	TA2714	US26D	MK	087100
1 Office Lock	MO 4604LN Temp Core	626	YA	087100
1 Core	A600	626	YA	087100

1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
3	Silencer	608/609 (TO SUIT)		RO	087100

Set: 55.65.60

Description: INT. PRIVACY

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Privacy Lock	MO 4602LN	626	YA	087100
1	Surface Closer	3501 (REG/PA) TO SUIT	689	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Mop Plate	K1050 4" CSK	US32D	RO	087100
1	Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
3	Silencer	608/609 (TO SUIT)		RO	087100
1	Coat Hook	RM802	US32D	RO	087100

Set: 55.95.50

Description: INT. PASSAGE

3	Hinge, Full Mortise	TA2714	US26D	MK	087100
1	Passage Latch	MO 4601LN	626	YA	087100
1	Kick Plate	K1050 10" CSK	US32D	RO	087100
1	Door Stop	403/441CU (TO SUIT)	US26D	RO	087100
3	Silencer	608/609 (TO SUIT)		RO	087100

Set: 75.04.50

Description: RESIDENT UNIT - ENTRY (MECHANICAL x SPRING HINGE)

3	Hinge (spring)	1502	US15	MK	087100
1	Passage Set	11 MO x UL	619	YR	087100
1	Deadbolt	83	626	YR	087100
1	Door Stop	505/528	US15	RO	087100
1	Threshold	EV232BL		PE	087100
1	Gasketing (Head/Jambs)	S88BL		PE	087100
1	Door Bottom	2343AV		PE	087100
1	Viewer	622	STNN	RO	087100

Notes: PROVIDE SECOND DOOR VIEWER (622) AT BARRIER FREE UNITS.

Set: 75.65.50

Description: RESIDENT UNIT - BEDROOM / BATHROOM

3	Hinge	BY PRE-HUNG DOOR SUPPLIER	619		
1	Privacy Lock	21 MO	626	YR	087100
1	Door Stop	505/528	US15	RO	087100

Notes: PROVIDE HINGE PIN OR BASE STOP PER OPENING CONDITIONS.

Set: 75.95.50

Description: RESIDENT UNIT - CLOSET (SINGLE)

3	Hinge	BY PRE-HUNG DOOR SUPPLIER	619		
1	Passage Latch	11 MO	626	YR	087100
1	Door Stop	505/528	US15	RO	087100

Notes: PROVIDE HINGE PIN OR BASE STOP PER OPENING CONDITIONS.

Set: 75.DTRL.00

Description: RESIDENT UNIT - CLOSET (PAIR)

6	Hinge	BY PRE-HUNG DOOR SUPPLIER	619		
2	Single Dummy	81 MO	626	YR	087100
2	Roller Latch	592	US26D	RO	087100
2	Door Stop	505/528	US15	RO	087100

Set: 87.FP

Description: RESIDENT UNIT - BYPASS

1	Bypass Hdwe	HBP200A		PE	087100
2	Flush Pull	872	US26D	RO	087100

Set: 88.0

Description: RESIDENT UNIT - TERRACE

1	Passage Latch	11 MO	626	YR	087100
1	Deadbolt	83	626	YR	087100

Notes: BALANCE OF HARDWARE BY DOOR SUPPLIER

Set: 95.95.95

Description: OVERHEAD/GATES

0 All Hardware BY DOOR SUPPLIER

Set: 99.99.99

Description: ACCENTRA SYSTEM ACCESORIES

2	Controller	NTX600-CTLR		YA	281500
2	Module	NTX600-ACC-Key		YA	281500
1	Credentials	NTX600-YALFOB-8K		YA	281500
1	Credentials	NTX600-YALCRD-8K		YA	281500
2	Updater	NTX610-UPDTR		YA	281500
1	Key Management System	EA-100117		MC	087100
1	Software (Annual)	ACC-SUB-500		YA	281500
1	System Commissioning	ACC-SUB-INIT		YA	281500
16	Remote Training (HOUR)	SW-503Remote		MC	087400
2	Site Training (DAY)	SW-503Site		MC	087400
2	Updater/Controller	NTX610-KIT		YA	

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Storefront framing.

1.3 DEFINITIONS

- A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- B. 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 ASTM E 1300 and Florida Building Code by a qualified professional engineer, licensed in the State of Florida, 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 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the State of Florida, responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, and glazing gaskets.
- C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

- B. 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. NGA Publications: "Laminated Glazing Reference Manual" and "GANA 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."
- C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.8 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.

1.10 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 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.
- 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. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
1. Small-Missile Test: For glazing located more than 30 feet above.
 2. Large-Missile Test: For all glazing, regardless of height above grade.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 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 C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C1048; 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).

2.3 LAMINATED GLASS

- A. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, and complying with testing requirements in 16 CFR 1201 for Category II materials with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article 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 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.
- B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

- A. Acceptable Manufacturers: Provide insulating glass units by one of the following manufacturers:
1. Cardinal Glass Industries.
 2. Guardian Glass.
 3. Viracon.
 4. Vitro Architectural Glass.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, 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.
 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article and 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. Neoprene complying with ASTM C864.
 2. EPDM complying with ASTM C864.
 3. Silicone complying with ASTM C1115.
 4. Thermoplastic polyolefin rubber complying with ASTM C1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, 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.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as 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.

2.7 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).

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.9 MONOLITHIC-GLASS TYPES

- A. Glass Type: Clear float glass; heat-strengthened or fully tempered as specified.
 1. Thickness: 6.0 mm.
 2. Provide safety glazing labeling.

2.10 LAMINATED--GLASS TYPES

- A. Glass Type: Clear laminated glass with two plies of heat-strengthened float glass.
 1. Thickness of Each Glass Ply: 3.0 mm.
 2. Interlayer Thickness: 0.060 inch.
 3. Provide safety glazing labeling.

2.11 LAMINATED INSULATING-GLASS TYPES

- A. Glass Type: Low-e-coated, insulating glass.
 1. Basis of Design Product: To be determined.
 2. Overall Unit Thickness: 1-5/16 inch.
 3. Thickness of Outdoor Lite: 6.0 mm.
 4. Outdoor Lite: Clear fully tempered float glass with VUE-50 #2.
 5. Interspace Content: Air.
 6. Indoor Lite: Clear laminated glass with two plies of heat strengthened float glass. Each ply 6.0 mm thick. 0.060 inch interlayer thickness.
 7. Low-E Coating: Sputtered on second surface.
 8. VLT: 48 percent.
 9. Winter U-Value: 0.29.
 10. Summer U-Value: 0.26.
 11. SHGC: 0.25.

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. 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.

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 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.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.
 - 2. Tempered glass mirrors qualifying as safety glazing.
- B. Related Requirements:
 - 1. Section 102800 "Toilet and Bath Accessories" for metal-framed mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of mirror, from manufacturer.
- C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
- D. Glazing Publications: Comply with the following published recommendations:
 - 1. NGA's "GANA Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - 2. NGA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- E. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.
 1. Manufacturers: Provide products by one of the following:
 - a. Arch Aluminum & Glass Co., Inc.
 - b. Binswanger Mirror; a division of Vitro America, Inc.
 - c. Guardian Industries.
 - d. Lenoir Mirror Company.
 - e. Virginia Mirror Company, Inc.
- B. Clear Glass: Mirror Select Quality.
 1. Nominal Thickness: 6.0 mm.
- C. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
 1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

2.3 MIRROR HARDWARE

- A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 inch and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.

- a. Products: Provide one of the following:
 - 1) Laurence, C. R. Co., Inc.; CRL Standard "J" Channel.
 - 2) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Shallow Nose "J" Moulding Lower Bar.
 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.062 inch.
 - a. Products: Provide one of the following:
 - 1) Laurence, C. R. Co., Inc.; CRL Deep "J" Channel.
 - 2) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Deep Nose "J" Moulding Lower Bar.
 3. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.
- 2.4 FABRICATION
- A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.
 - B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
 - C. Mirror Edge Treatment: Flat polished.
 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.

3.3 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.
- C. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

- A. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

- B. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade shall pass basic protection, when tested according to AMCA 540.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade, Windborne-Debris-Impact-Resistant Louver:
 - 1. Basis of Design Product: Construction Specialties, Inc.; Model DC-5304. Other acceptable manufacturers:
 - a. Airolite.
 - b. Greenheck.
 - c. Ruskin.
 - 2. Louver Depth: 6 inches.
 - 3. Frame and Blade Nominal Thickness: Not less than .080 inch.
 - 4. Mullion Type: Exposed.
 - 5. Louver Performance Ratings:
 - a. Free Area: Not less than 9.41 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration: Not less than 1077 fpm.
 - c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area intake velocity.
 - 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 7. AMCA Rating: AMCA 540.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening.

- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Non-rewireable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch thick.

2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, 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 according to ASTM E 488/E 488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Interior flange unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and 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.
 1. Color and Gloss: As scheduled or as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, 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. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092116 - 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For shaft wall assemblies and firestop tracks, 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 C840 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 E119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. STC Rating: 51, minimum.
- C. 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: As indicated.
- D. 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.
- E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.
- F. Room-Side Finish: As indicated.
- G. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
- H. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Gypsum Shaftliner Board, Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Products: Provide one of the following:
 - a. CertainTeed Corp.; ProRoc Shaftliner.
 - b. Continental Building Products; Shaftliner Type X.
 - c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
 - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
 - e. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
 2. Thickness: 1 inch.
 3. Long Edges: Double bevel.
- C. Gypsum Shaftliner Board, Moisture-Resistant and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
1. Products: Provide one of the following:
 - a. CertainTeed Corp.; ProRoc Moisture and Mold Resistant Shaftliner.
 - b. Continental Building Products; Mold Defense Shaftliner Type X.
 - c. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Dens-Glass Ultra Shaftliner.
 - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
 - e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Liner Panel.
 2. Thickness: 1 inch.
 3. Long Edges: Double bevel.
 4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- D. Gypsum Board: As specified in Section 092900 "Gypsum Board."
- E. Cementitious Backer Units: As specified in Section 092900 "Gypsum Board."
- 2.4 NON-LOAD-BEARING STEEL FRAMING
- A. Steel Framing Members: Comply with ASTM C645 requirements for metal unless otherwise indicated.
 1. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized.
 - B. 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: Provide one of the following:
 - a. Fire Trak Corp.; Fire Trak System.
 - b. Metal-Lite, Inc.; The System.
 - c. Steel Network Inc. (The); VertiClip 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 C1002 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 E488 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 E1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."
- F. Acoustical Sealant: As specified in Section 092900 "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, 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 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. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.
- 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 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 at locations indicated on Drawings while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- 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.

3.3 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 092116

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS

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

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 E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A653/A653M, G60, hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide[one of] the following:
1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 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: Provide one of the following:
 - 1) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 2) Steel Network Inc. (The); VertiClip SLD Series.
 - 3) Superior Metal Trim; Superior Flex Track System (SFT).
 - 4) Telling Industries; Vertical Slip Track.
- D. 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: Provide one of the following:
 - a. Fire Trak Corp.; Fire Trak System.
 - b. GCP Applied Technologies; Grace FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
 2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. 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 A641/A641M, 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 A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Rockfon; Chicago Metallic 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 D226, 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.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. **Gypsum Board Assemblies:** Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. **Single-Layer Application:** 16 inches o.c. unless otherwise indicated.
 - 2. **Multilayer Application:** 16 inches o.c. unless otherwise indicated.
 - 3. **Tile Backing Panels:** 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.

- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. 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.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
1. 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 072100 "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.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- 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. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. 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.

- F. 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 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 079219 "Acoustical Joint Sealants."

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 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 E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Provide products by one of the following:
 1. CertainTeed Corp.
 2. Georgia-Pacific Gypsum LLC.
 3. Lafarge North America Inc.
 4. National Gypsum Company.
 5. Temple-Inland.
 6. USG Corporation.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
 1. Basis of Design: National Gypsum Company; Gold Bond Fire-Shield.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered.
- C. Gypsum Ceiling Board, Type C: ASTM C1396/C1396M.
 1. Basis of Design: National Gypsum Company; Gold Bond Gypsum Board.
 2. Thickness: 5/8 inch.
 3. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C1629/C1629M, Level 2.

1. Basis of Design: National Gypsum Company; Gold Bond XP.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Basis of Design: National Gypsum Company; Permabase Cement Board: One acceptable products:
 - a. CertainTeed Corp.; FiberCement Underlayment.
 - b. Custom Building Products; Wonderboard.
 - c. James Hardie Building Products, Inc.; Hardiebacker.
 - d. USG Corporation; DUROCK Cement Board.
2. Thickness: As indicated.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M with manufacturer's standard edges.

1. Basis of Design: National Gypsum Company; Gold Bond e2 Tile Backer.
2. Core: 5/8 inch Type.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, 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. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. 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 high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- 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. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Specified in Section 079219 "Acoustical Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "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 C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- 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 C919 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: All surfaces unless otherwise indicated.
- 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.

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 at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: For back-of-the-house areas not accessible to residents or public. Also for detached garages.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated. Primer and its application to surfaces are specified in Section 099100 "Painting."
 - 5. Level 5: Where indicated on Drawings. Primer and its application to surfaces are specified in Section 099100 "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 092900

SECTION 093013 - PORCELAIN TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Porcelain tile.
- 2. Ceramic tile.
- 3. Crack isolation membrane.
- 4. Stone thresholds.

- B. Related Requirements:

- 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
- 2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 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 its "Specifications for Installation of Ceramic Tile."

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Stone thresholds in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products.

1.7 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 5 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.

1.9 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.

1.10 FIELD 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.
 - 1. Provide tile complying with Standard grade requirements.
- 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 TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. 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.

2.2 TILE PRODUCTS

- A. Basis of Design Products, Floor Tile: As scheduled on Drawings.
- B. Basis of Design Products, Wall Tile: As scheduled on Drawings.

- C. Tile Wall and Floor Tile Applications: Refer to Drawings.
- D. Tile and Grout Colors:
 - 1. Tile Color: As scheduled on Drawings.
 - 2. Grout Color: As scheduled on Drawings.
- E. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide manufacturer's standard shapes.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Stone Thresholds: Refer to Finish Legend on Drawings.

2.4 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 - 1. Basis of Design Product: Laticrete International Inc.; Hydro Ban.

2.5 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Basis of Design Manufacturer: LATICRETE SUPERCAP, LLC.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
- B. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
 - 1. Basis of Design Manufacturer: LATICRETE International Inc.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.6 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
 1. Basis of Design Product: LATICRETE international Inc.; Permacolor Select.
 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.7 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. 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.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- 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.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA 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 TCNA 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 consisting of tiles 8 by 8 inches or larger.
- 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. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 2. 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. Porcelain Tile: 3/16 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. 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.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. Do not extend crack isolation membrane under thresholds set in standard dry-set or modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Ceramic Tile Installation: TCNA F113; thinset mortar.
 - a. Thinset Mortar: Modified dry-set and medium-bed, modified dry-set mortar.
 - b. Grout: High-performance sanded grout.
 - 2. Ceramic Tile Installation: TCNA F125-Full, except where partial coverage is indicated; thinset mortar on crack isolation membrane.
 - a. Thinset Mortar: Medium-bed, modified dry-set mortar.
 - b. Grout: High-performance sanded grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W243; thinset mortar on gypsum board.
 - a. Thinset Mortar: Modified dry-set mortar.
 - b. Grout: High-performance sanded grout.

2. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units.
 - a. Thinset Mortar: Modified dry-set mortar.
 - b. Grout: High-performance sanded grout.

END OF SECTION 093013

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic-rubber base.
 - 2. Vinyl molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 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.

1.5 FIELD 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 periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and 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 THERMOPLASTIC-RUBBER BASE

- A. Acceptable Manufacturers: One of the following:
 - 1. Burke Mercer Flooring Products.
 - 2. Flexco.
 - 3. Johnsonite.
 - 4. Roppe Corporation:
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings.
- C. 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. Colors: As selected by Architect from manufacturer's full range.

2.2 VINYL MOLDING ACCESSORY

- A. Acceptable Manufacturers: One of the following:
 - 1. Burke Mercer Flooring Products.
 - 2. Flexco.
 - 3. Johnsonite.
 - 4. Roppe Corporation:
- B. Description: Vinyl caps, edges, reducer strips and joiners.
- C. Profile and Dimensions: As indicated.

- D. Locations: Provide vinyl molding accessories in areas indicated.
- E. Colors and Patterns: Refer to Finish Legend on Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - 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. Luxury vinyl floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish five boxes for every 100 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors 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 floor tile manufacturer for installation techniques required.

1.8 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.

1.9 FIELD 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 periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and 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 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL TILE

- A. Basis of Design Product: As scheduled on Drawings.
- B. Classification: Class III, Type B; ASTM F1700.
- C. Plank Size: As scheduled on Drawings.
- D. Installation Methods: Direct glue or perimeter glue.
- E. Adhesive: Manufacturer's standard.
- F. Performance Criteria:
 - 1. Static Load: 1200 psi, passes; ASTM F970.
 - 2. Coefficient of Friction: Minimum 0.5; ASTM D2047.

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 floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

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 in pattern indicated.
- 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 in pattern of colors and sizes indicated.
- 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 marking device.
- G. Adhere floor tiles 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.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096566 - 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details and locations of the following:
 - 1. Border tiles.
 - 2. Floor patterns.
 - 3. Seam locations for sheet flooring.
- C. 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.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sheet Flooring: Furnish full-width rolls of not less than 25 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of flooring installed.

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 storing.
- B. Store materials to prevent deterioration. Store [tiles on flat surfaces] [and] [rolls upright].

1.7 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.

PART 2 - PRODUCTS

2.1 RUBBER SHEET FLOORING

- A. Basis-of-Design Product: Johnsonite; Replay.
- B. Description: Rubber athletic flooring provided as rolled goods for adhered installation.
- C. Description: Wear layer and rubber backing composite product; 0.375 inch total thickness. 48 inch rolls. Coefficient of friction greater than 0.6 per ASTM D2047.
- D. Traffic-Surface Texture: Manufacturer's standard.
- E. Color and Pattern: As scheduled on Drawings.
- F. Border: Interlocking, beveled-edge tiles, of same material as floor tile; with bevels that transition from thickness of floor tile to surface below it; with straight outside edges; and for use where flooring corners and edges do not abut vertical surfaces.
 - 1. Border Color and Pattern: Matching floor tile.

2.2 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.

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 F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity Testing: Perform pH testing according to ASTM F710. 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 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 096566

SECTION 096813 - 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 modular carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing 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.

C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.6 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.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.9 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" 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 levels planned for building occupants 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.

1.10 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, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Basis of Design Products: As scheduled on Drawings.
- B. Colors and Patterns: As scheduled on Drawings.
- C. Dye Method: Solution dyed.

- D. Construction: Multilevel pattern loop.
- E. Backing System: Manufacturer's standard.
- F. Sizes: As scheduled on Drawings.
- G. Applied Treatments:
 - 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
 - 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- H. Performance Characteristics:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 - 2. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
 - 3. Rating: Heavy traffic.

2.2 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 comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

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.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by tile carpeting manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by tile carpeting manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to tile carpeting manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. 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.
- D. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.

- D. Maintain pile-direction patterns indicated on Drawings.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- 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 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's "Carpet Installation Standard," Section 20, "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 096813

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Tufted carpet.
- 2. Carpet cushion.

- B. Related Requirements:

- 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
- 2. Section 096813 "Tile Carpeting."

1.3 ACTION SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:

- 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- 2. Carpet Cushion: for each type indicated. Include manufacturer's written data on physical characteristics and durability.

- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

- 1. Carpet: 12-inch-square Sample.

- C. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 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 and carpet cushion identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.10 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, excess static discharge, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Warranty for Carpet Cushion: Manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty includes consequent removal and replacement of carpet and accessories.
 - 2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 3. Failure includes, but is not limited to, permanent indentation or compression.
 - 4. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

- A. Basis-of-Design Product: As scheduled on Drawings.
- B. Color: As indicated or scheduled on Drawings.
- C. Pattern and Style: As indicated or scheduled on Drawings.
- D. Fiber: PET fiber.
- E. Face Weight: 25 oz./sq. yd.
- F. Primary Backing: Manufacturer's standard material.

- G. Secondary Backing: Manufacturer's standard material.
- H. Backcoating: Manufacturer's standard material.
- I. Width: 12 feet.
- J. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- K. Antimicrobial Treatment: Manufacturer's standard material.
- L. Performance Characteristics: As follows:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
 - 2. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
 - 3. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
 - 4. Low VOC Carpet: Provide for walled-in bedrooms and walk-in closets directly accessed from bedrooms.

2.2 CARPET CUSHION

- A. Basis-of-Design Product: As indicated or scheduled on Drawings. Provide for bedrooms and walk-in closets. 1/2 inch thick 6 lb. re-bond pad.
- B. Performance Characteristics: As follows:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet 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 manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet.
 - 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 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch 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 manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Double-Glue-Down Installation: Comply with CRI 104, Section 10, "Double Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- D. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. Comply with carpet cushion manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 2. Remove yarns that protrude from carpet surface.
 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet 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 manufacturer.

END OF SECTION 096816

SECTION 099100 - 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. This Section includes surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
 - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork and casework.
 - b. Acoustical ceiling panels.
 - c. Elevator entrance doors and frames.
 - d. Elevator equipment.
 - e. Finished mechanical and electrical equipment.
 - f. Light fixtures.
 - g. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Pipe spaces.
 - e. Duct shafts.
 - f. Elevator shaft.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Brass and bronze.
 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual Global (FMG), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Requirements:
1. Section 051200 "Structural Steel" for shop priming structural steel.
 2. Section 055000 "Metal Fabrications" for shop priming ferrous metal.
 3. Section 081113 "Hollow Metal Steel Doors and Frames" for shop priming steel doors and frames.
 4. Divisions 23 and 26: Painting mechanical and electrical work is specified in Divisions 23 and 26, respectively.

1.3 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 - 1. Material List: Provide an inclusive list of required coating materials. Identify each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish coat material indicated.
 - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
 - 1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owner, and other information specified.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Quality Standard: Refer to Milhaus Development's "Architectural Building Standards Manual" for additional requirements for paint substrates, including sheen levels.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.

- B. Store materials not in use in tightly covered containers in a well ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

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

- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

- C. Do not apply paint in rain, fog or mist, when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Products specified in Paint Schedules at the end of this Section are produced by The Sherwin-Williams Company (S-W). Equivalent products by one of the following manufacturers (or an acceptable equivalent) are also acceptable:
1. Benjamin Moore and Co.
 2. Glidden Professional.
 3. PPG Industries, Inc.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products names are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

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

- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Surfaces: Prepare concrete, concrete masonry block, cement and plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - 3. Wood: clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

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

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Ductwork.
 3. Insulation.
 4. Motors and mechanical equipment.
 5. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Switchgear.
 3. Panelboards.
- H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed substrates where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

- J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats.
- K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- L. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 CLEANING

- A. Clean-Up: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

- A. Exterior Stucco and Concrete Masonry Unit Substrates: Acrylic latex coating system.
 - 1. Primer: S-W Loxon Block Surfacers, A24W200.
 - 2. 1st and 2nd Finish Coats: S-W Loxon XP, A24-1400 Series.
- B. Exterior Concrete Substrates: Acrylic latex coating system.
 - 1. Primer: S-W Loxon Concrete Masonry Primer, B24W8300.
 - 2. 1st Finish Coat: S-W Ultracrete Textured Acrylic Masonry Topcoat, A44W800 Series.
 - 3. 2nd Finish Coat: S-W Duration K33 Exterior Acrylic Latex Satin.
- C. Exterior Galvanized Metal Substrates: Water-based urethane coating system. Each coat applied at spreading rate and mil thickness recommended by manufacturer.
 - 1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 - 2. 1st and 2nd Finish Coats: S-W Hydrogloss Single Component Water Based Urethane Gloss, B65 Series.
- D. Exterior Ferrous Metal Substrates: Water-based urethane coating system. Each coat applied at spreading rate and mil thickness recommended by manufacturer.
 - 1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 - 2. 1st and 2nd Finish Coats: S-W Hydrogloss Single Component Water Based Urethane Gloss, B65 Series.

3.8 INTERIOR PAINT SCHEDULE

- A. Interior Wood Substrates, Transparent Finish: Transparent polyurethane finish coat system.
 - 1. Stain: S-W Wood Classics Interior Oil Stain, A49 Series.
 - 2. 1st and 2nd Finish Coats: Wood Classics Waterborne Polyurethane Finish, A68 Series, Satin or Gloss as scheduled.
- B. Interior Wood Substrates (Including Trim Units), Opaque Finish: Acrylic latex semi-gloss coating system.
 - 1. Primer: S-W Multi-Purpose Latex Primer Interior/Exterior Primer, B51-450 Series.
 - 2. 1st and 2nd Finish Coats: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series.

- C. Gypsum Board Substrates: Acrylic latex flat coating system.
1. Primer: S-W Multi-Purpose Latex Primer Interior/Exterior Primer, B51-450 Series.
 2. 1st and 2nd Finish Coats: S-W ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
- D. Gypsum Board Substrates: Acrylic latex semi-gloss coating system.
1. Primer: S-W Multi-Purpose Latex Primer Interior/Exterior Primer, B51-450 Series.
 2. 1st and 2nd Finish Coats: S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series.
- E. Gypsum Board Substrates: Water-based epoxy semi-gloss coating system.
1. Primer: S-W Multi-Purpose Latex Primer Interior/Exterior Primer, B51-450 Series.
 2. 1st and 2nd Finish Coats: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss, K46 Series.
- F. Interior Galvanized Metal Substrates: Acrylic latex coating system.
1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 2. 1st and 2nd Finish Coats: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.
- G. Interior Galvanized Metal Substrates: Water-based epoxy semi-gloss coating system.
1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 2. 1st and 2nd Finish Coats: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss, K46 Series.
- H. Interior Ferrous Metal Substrates: Acrylic latex semi-gloss coating system.
1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 2. 1st and 2nd Finish Coats: S-W ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series.

- I. Interior Ferrous Metal Substrates: Water-based epoxy semi-gloss coating system.
 1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
 2. 1st and 2nd Finish Coats: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss, K46 Series.

END OF SECTION 099100

SECTION 101423 - 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. Panel 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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 other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.

- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Panel Signs: Not less than 12 inches square, including corner.
- E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 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 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards.

2.2 PANEL SIGNS

- A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Provide products by one of the following:
 - a. APCO Graphics, Inc.
 - b. ASI Sign Systems, Inc.
 - c. Best Sign Systems, Inc.
 - d. Inpro Corporation.
 - e. Nelson-Harkins Industries.
 - f. Seton Identification Products.
 2. Laminated Polycarbonate-Sheet Sign: Polycarbonate face sheet laminated to each side of phenolic base sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
 - b. Surface-Applied, Flat Graphics: Applied vinyl film.
 - c. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
 - d. Subsurface Graphics: Reverse halftone or dot-screen image.
 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: As indicated on Drawings.
 - b. Corner Condition in Elevation: As indicated on Drawings.
 4. Frame: Entire perimeter.
 - a. Material: Aluminum.
 - b. Frame Depth: As indicated on Drawings.
 - c. Profile: As indicated on Drawings.
 - d. Corner Condition in Elevation: As indicated on Drawings.
 - e. Finish and Color: As selected by Architect from manufacturer's full range.
 5. Mounting: As indicated on Drawings.
 6. Text and Typeface: As indicated on Drawings.

2.3 PANEL-SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

- D. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- E. 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 on Drawings and suitable for exterior applications.
- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.
- B. Adhesive: As recommended by sign manufacturer.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the 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. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- D. 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.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Accessible Signage: Install in locations on walls as indicated on Drawings.
- C. Mounting Methods:
 - 1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

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 101423

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A240/A240M.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90-degree or 135-degree turn to match wall condition.
 - 1. Manufacturers: Provide products by one of the following:
 - a. Arden Architectural Specialties, Inc.
 - b. Balco, Inc.

- c. Construction Specialties, Inc.
 - d. InPro Corporation.
 - e. Tepromark International, Inc.
2. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0500 inch.
 - b. Finish: Directional satin, No. 4.
 3. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
 4. Corner Radius: 1/8 inch.
 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.3 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. 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.

2.4 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Remove tool and die marks and stretch lines, or blend into finish.
 2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 3. Run grain of directional finishes with long dimension of each piece.
 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. 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.
- C. 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.
 - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.

END OF SECTION 102600

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Toilet and bath accessories.
 - 2. Childcare accessories.

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 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, 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.

1.7 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.

1.8 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 A666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 TOILET AND BATH ACCESSORIES

- A. Basis of Design Products, Bathrooms and Restrooms: As scheduled or indicated on Drawings, unless otherwise specified herein.

2.3 CHILDCARE ACCESSORIES

- A. Diaper-Changing Station:
 - 1. Basis of Design Product: Koala Kare Products; Model KB110-SSWM.
 - 2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250-lb static load when opened.
 - 3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
 - 6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.4 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 F446.

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 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis of Design Product: Larsen's Manufacturing Company; 2409 Series. Comparable products by one of the following manufacturers also acceptable:
 - a. JL Industries, Inc.
 - b. Modern Metal Products.
 - c. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated and rated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Recessed Cabinet:
 - 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. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Tempered clear float glass.
- 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 projecting lever handle with cam-action 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. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 3. Door Lock: Cylinder lock, keyed alike to other cabinets.
 4. 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 location indicated on Drawings.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: As indicated on Drawings.
- L. Materials:
1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.

2. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where 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 semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

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. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Basis of Design Product: Larsen's Manufacturing Company; MP Series. Comparable products by one of the following manufacturers also acceptable:
 - a. Amerex Corporation.
 - b. Ansul Incorporated.
 - c. Buckeye Fire Equipment Company.
 - d. JL Industries, Inc.
 - e. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - f. Potter Roemer LLC.
 - 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.
- C. Multipurpose Dry-Chemical Type in Steel Container, Residences: UL-rated 1-A:10-B:C, 2.5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- 1. Manufacturer: Fire extinguisher manufacturer.
- 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: 54 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 104416

SECTION 105500 - USPS-DELIVERY POSTAL SPECIALTIES

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. Mail receptacles.
- 2. Accessories.

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 postal specialty.

- B. Shop Drawings: For postal specialties.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Include identification sequence for compartments.
- 3. Include layout of identification text.
- 4. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the Work of other Sections.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified installer.

- B. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer. Include written approval by Postmaster General.

- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing postal specialties and whose installations have been given final approval by local postmasters authorizing use by USPS.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Furnish lock keys according to USPS requirements; with temporary identification for their respective locks, bagged, and securely taped inside the collection compartment for shipping.

1.8 COORDINATION

- A. Coordinate layout and installation of recessed postal specialties with wall construction.
- B. Templates: Obtain templates for installing postal specialties and distribute to parties involved.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of postal specialties 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 hardware.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MAIL RECEPTACLES

- A. Front-Loading Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within a recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C.
1. Basis of Design Product: Florence Corporation; 4CADD-9.
 2. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock.
 - a. Master-Door Lock: Door prepared to receive lock provided by local postmaster.
 3. Compartments: Number and size as follows:
 - a. Type II: A group of mail receptacles in double-column configuration with double master door, 9 mail compartments not less than 3 inches high by 12 inches wide by 15 inches deep, one outgoing mail collection compartment prepared for master-door lock, and two parcel-locker compartments 15 inches high by 12 inches wide by 15 inches deep. One outgoing mail compartment 1-3/4 inches high by 12 inches wide by 15 inches deep. One master collection compartment 3 inches high by 12 inches wide by 15 inches deep.
 4. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by USPS-STD-4C. Provide mail slot in the compartment with master-door lock.
 - a. Compartment-Door Locks: Comply with USPS-L-1172C for locks and keys, or equivalent as approved by the USPS; with three keys for each compartment door. Key each compartment differently.
 - b. Parcel-Locker-Compartment-Door Locks: Two-key security system in which control key provides access to parcel-locker-compartment key, which opens compartment and is retained once opened.
 5. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
 6. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 7. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:

- a. Baked-Enamel or Powder-Coated Finish: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Key Cabinet: Wall-mounted, steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder-door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel or powder-coated finish. Key-control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
 - 1. Capacity: Keys for 150 percent of the number of mail-receptacle locks.
 - 2. Cross-Index System: Consisting of index cards for recording key information. Include three receipt forms for each key-holding hook.
 - 3. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.
- B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.
- C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.
- E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.
- F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.
- G. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for roughing-in openings, clearances, and other conditions affecting performance of the Work.
- B. Examine walls and other adjacent construction for suitable conditions before 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 INSTALLATION

- A. Install postal specialties level and plumb, according to manufacturer's written instructions.
 - 1. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer.
 - 2. Where aluminum contacts grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
 - 3. Final acceptance of postal specialties served by the USPS depends on compliance with USPS requirements.
- B. Mail Receptacles: Install mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by the USPS and manufacturer's written instructions.

1. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.

3.3 FIELD QUALITY CONTROL

- A. Arrange for USPS personnel to examine and test postal specialties served by the USPS after they have been installed according to USPS regulations.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.
- C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal-specialty manufacturer.
- D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. On completion of postal-specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 105500.13

SECTION 109050 - MISCELLANEOUS SPECIALTIES

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. Types of miscellaneous specialties required include:
 - 1. Commercial car charging station.
 - 2. Bike Racks.
 - 3. Fire pit.
 - 4. Dog park.
 - 5. Artificial turf.
 - 6. Automobile entry gate system.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for all items specified herein.
- B. Shop Drawings: Submit shop drawings showing complete fabrication and installation details for all items specified herein.
- C. Samples: As may be requested by Architect.

PART 2 - PRODUCTS

2.1 COMMERCIAL CAR CHARGING STATION

- A. Description: Dual-port bollard mount unit with software package. 208V, 60 Hz, 3 Phase service required; GFCI protected.
 - 1. Basis of Design: ChargePoint; CT4000 Level 2 Commercial Charging Station.

2.2 BIKE RACKS

- A. Exterior Bike Racks: 1-1/2 inch diameter Schedule 40 galvanized steel pipe bike racks for in-ground attachment. Powder coat finish in color selected by Architect. Rack profile and number as indicated on Drawings.
 - 1. Basis of Design: Dero; Commercial Bike Rack.
- B. Interior Bike Racks: Sliding arm system with square metal tube arms. Schedule 40 galvanized pipe crossbeams. Galvanized steel channel feet. Tamperproof locking bolts. Powder coat finish in color Black.
 - 1. Basis of Design: Dero; Ultra Space Saver Squared.

2.3 FIRE PIT

- A. Description: Fire pit for natural gas operation. Stainless steel gas timer box.
- B. Basis of Design: R. H. Peterson Co.; Fire Magic with Model 5520-11T timer.

2.4 DOG PARK

- A. Description: Stainless steel watering station and powder-coat finish dog waster station.
- B. Basis of Design: Dog-On-It Parks; Dog Watering Station #7213 and Single Pull Dog Waste Station #74085.

2.5 ARTIFICIAL TURF

- A. Description: Artificial turf, aggregate drainage base, securement devices, and edging.
- B. Basis of Design: Forever Lawn; K9 Grass System.

2.6 AUTOMOBILE ENTRY GATE SYSTEM

- A. Gate Operator: Wireless communication with battery backup. Surge suppression protection. Encrypted signal. Emergency disconnect. Obstruction sensor. Fire Department compliance. Anti-tailgate quick-close. Zinc-plates steel chassis. High-density, UV-resistant polycarbonate cover.
 - 1. Basis of Design: Lift Master; 24 VDE High-Traffic Commercial Swing Gate Operator.
 - 2. Electrical Requirements: 120/230 VAC single-phase. 24 VDC continuous-duty motor.

- B. Telephone Entry System, Pedestal Mounted: Stainless steel enclosure with epoxy finish. Omni directional microphone. Standard 250 tenant capacity, expandable. Each tenant has 4-6 digit ID code; 2 telephone numbers per tenant. Vandal-resistant LCD display. Fully programmable Battery backup in event of power failure. Welded structural aluminum pedestal with mounting base plate in manufacturer's standard weather-resistant finish; 42 inch pedestal height.
 - 1. Basis of Design, Telephone Entry System: Tyco Security Product; Kantech Telephone Entry System.
 - 2. Basis of Design, Pedestal: Select Entry Systems; Pedestal Model No. PST242.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install all miscellaneous specialties in accordance with applicable standards, manufacturer's published instructions and current recommendations, and approved shop drawings.

END OF SECTION 109050

SECTION 113013 - RESIDENTIAL APPLIANCES

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. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Cleaning appliances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Manufacturers: As specified herein.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

2.3 COMMON AREA APPLIANCES

- A. Ice Machines: Summit; BIM44GADA. ADA compliant. NSF listed.
- B. Refrigerator: Summit; AL54. ADA compliant.
- C. Refrigerator (Parcel Delivery): Centaur; CSD-2DR-BAL54. Two-section reach-in.
- D. Beverage Center: Summit; AL57GCSS ADA. ADA compliant.
- E. Dishwasher: Summit; DW2435SSADA. European design. ADA compliant. Energy Star certified.
- F. OTR Microwave: Summit; OTRSS301.
- G. Countertop Microwave: Summit; SCM853.
- H. Outdoor Grill: Coyote; C2C36. 80,000 BTU output.

2.4 UNIT APPLIANCES

- A. Refrigerator: GE; GIE18GSNRSS. Energy Star certified. Top freezer. 17.5 cu. ft.
- B. Refrigerator, ADA Compliant: GE; GIE19JSNRSS. Energy Star certified. Includes icemaker. 19.2 cu. ft.
- C. Alternate Refrigerator: GE; GIE22JSNRSS. Energy Star certified. Top freezer. 21.9 cut. Ft. ADA compliant.
- D. Dishwasher: GE; GDF510PSMSS. Front controls.
- E. Dishwasher, ADA Compliant: GE; GDT225SSLSS. Top controls.
- F. Electric Range: GE; J8625RSS. 30" freestanding range with ceramic glass cooktop.
- G. Electric Range, ADA Compliant: GE; JD630SFSS. 30" drop-in range with ceramic glass cooktop and front controls.
- H. OTR Microwave: GE; JNM3163RJSS. 1.6 cu. ft. Over-the-range microwave oven with recirculating venting.
- I. Countertop Microwave with Non-Vent Hood Over Range, ADA Compliant: GE; PEM31SMSS microwave oven and PJV348LSS range hood. 1.0 cu. ft. oven.
- J. Washer, ADA Compliant: GE; GFW510SCNWW. 4.5 cu. ft. front load. Energy Star certified. Vent system and sanitize cycle.
- K. Dryer, ADA Compliant: GE; GFD40ESCMWW. 7.8 cu. ft. capacity front load with sanitize cycle.
- L. Stack Kit for Laundry: GE; GEFLSTACK. Washer/dryer stack bracket kit.
- M. Top Load Washer: GE; GTW465ASNWW. 4.5 cu. ft. capacity. Stainless steel basket.
- N. Top Load Dryer: GE; GTX2EASJWW. 6.2 cu. ft. capacity electric dryer. Aluminized alloy drum.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance 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 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

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

END OF SECTION 113013

SECTION 118226 - FACILITY WASTE COMPACTORS

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 waste compactors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties and accessories, and finishes.
- B. Shop Drawings: For each waste compactor and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Indicate equipment access points and required space for equipment service and operation.
 - 4. Include setting drawings, templates, and instructions for installing anchor bolts and other anchorages.
 - 5. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of waste compactor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For waste compactors to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

- A. Waste Compactor: Manufacturer's standard compactor-container (combination-container)-type stationary compactor, complying with requirements; liquidtight; and with components, options, and accessories needed to provide a complete, functional system.
1. Basis of Design Product: Marathon Equipment Company, a Dover company; Model RJ-250SC.
 2. Waste-Compactor Standards: ANSI Z245.2 and NFPA 82. OSHA compliant. WASTEC certification.
 3. Rated Size (Volume): Minimum 34 cu. yd.
 4. Cycle Time: Maximum 33 seconds.
 5. Normal Force: Minimum 39,900 lbs.
 6. Maximum Force: Minimum 49,500 lbs.
 7. Normal Ram Face Pressure: Minimum 27.1 psi.
 8. Maximum Ram Face Force: Minimum 33.7 psi.
 9. Ram Penetration: 6 inches.
 10. Electrical Characteristics:
 - a. Horsepower: 10 hp.
 - b. Motor Voltage: 208 V ac, three phase, 60 hertz.
 - c. Control Voltage: 120 VAC.
 11. Controls: UL label control box. Remote power unit with controls mounted in face of box. NEMA Type 3, all circuits fused. Keylock start/stop/reverse.
 12. Hydraulic Equipment:
 - a. Hydraulic Pump Capacity: 9 gpm.
 - b. Normal System Pressure: 1,850 psi.
 - c. Maximum System Pressure: 2,300 psi.

13. Features:
- a. Full door weathertight seal.
 - b. Continuous feed capability.
 - c. Cyclic control system.
 - d. Odor and pest control provisions.
 - e. UL listed.
 - f. Fire hose connection.

14. Finish: Manufacturer's standard.

- a. Color: As selected by Architect from manufacturer's full range.

15. Deodorizing Device: Manufacturer's standard.

B. Number of Extra Storage Containers: One.

2.2 FABRICATION

- A. Fabricate waste compactors with smooth, eased, exposed edges to prevent injury to persons in vicinity of the equipment.
- B. Fabricate containers, hoppers, compaction chambers, unit bodies, and similar components of steel with welded joints. Reinforce with steel members sized and spaced to withstand impacts and pressures of normal operations and to prevent deformation.
- C. Fabricate equipment with replaceable parts at points of normal wear.
- D. Fabricate liquidtight compactor baffles to stop liquid from leaking out.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, clearances, service rough-ins, and other conditions affecting performance of the Work.
- B. Examine walls, floors, and chutes for suitable conditions where each waste compactor will be installed.
- 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 INSTALLATION

- A. Install each waste compactor according to manufacturer's written instructions, ANSI Z245.2, and ANSI Z245.21.
- B. Set waste compactors level, plumb, properly aligned, and securely in place. Anchor as required for secure operation.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform installation and startup checks according to ANSI Z245.21, Appendix D, "Tests for Evaluation of Equipment and Performance," and manufacturer's written instructions.
 - 2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Verify unrestricted access to each firefighting access door or hose connection required by ANSI Z245.21 and NFPA 82 for compactor container(s).
 - 4. Verify correct locations, color coding, and legibility of caution, warning, and danger markings.
 - 5. Certify compliance with test parameters.
- B. A waste compactor will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's written instructions and ANSI Z245.2.

END OF SECTION 118226

SECTION 122113 - WIRE STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of shelving:
 - 1. Vinyl-coated ventilated shelving.
 - 2. Shelving accessories.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical data, including specifications and installation instructions.
- B. Shop Drawings: Submit complete shop drawings. Show dimensions of shelving and interface with other products based on field verified dimensions.

1.3 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on approved shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials to the Project site in their original unbroken containers bearing manufacturer's name, brand and specification designation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: ClosetMaid (Clairson International).

2.2 MATERIALS

- A. Steel Wire: Basic cold drawn, Grade C-1006; average tensile strength over 100,000 psi; coated.
- B. Wire Coating: Proprietary heavy-duty polyvinyl chloride (PVC) formula resin, plasticizers, stabilizers, pigments, and other additives.
 - 1. Thickness: 9.0 mils to 11.0 mils.

2.3 FABRICATED UNITS

- A. Wire Shelving: Coated steel wire, 1/2 inch to 1 inch incremental cross-deck spacings. Applications, lengths, and depths as indicated on Drawings.
- B. Accessories: Manufacturer's standard components as follows and to suit installation requirements:
 - 1. Wall Clips.
 - 2. End Brackets.
 - 3. Support Brackets.
 - 4. Poles.
 - 5. Standards.
 - 6. Shelf Brackets.
 - 7. Pole Clips.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions under which installation is to be performed.
- B. Verification of Conditions:
 - 1. Prepared spaces are sized and located in accordance with approved shop drawings.
 - 2. Framing, reinforcement, and anchoring devices are correct type and are located in accordance with approved shop drawings.

3.2 INSTALLATION

- A. General: At a minimum, brace/secure shelf supports to three or more stud locations, spaced maximum 4 feet o.c.

- B. Cut shelves 1/2 inch to 1-3/8 inches shorter than actual measurements; cap all exposed ends.
- C. Install shelving plumb and level at heights indicated in accordance with approved shop drawings and manufactured published installation instructions.
- D. Place wall clips 10 inches to 12 inches on level line.
- E. Install end brackets on same level line as wall clips, centered on the front rods of shelves. Support shelves 36 inches maximum with end brackets, support brackets, or poles.
- F. Drill holes where required using sharp bit; do not punch.
- G. Drywall: Drill 1/4 inch hole and insert wall clip. Use No. 8 pin to expand anchor.
- H. Wood: Drill 1/4 inch hole into wood, secure wall clip with No. 8 by 1 inch screw or secure pole clip directly to wood with No. 8 by 1-1/4 inch screws.
- I. Concrete: Drill 1/4 inch hole with masonry bit, insert wall clip, and secure with No. 8 by 1 inch screws.
- J. Standards and Brackets:
 - 1. Install standards vertically every 16 inches on studs.
 - 2. Install horizontal tracks level, secured with screws or mollies in studs or drywall; use hanging adapters to connect wall standards for hanging.
 - 3. Attach shelf brackets with manufacturer's standard components.
- K. Shelf Supports:
 - 1. Place shelf support brackets vertically to the shelf. Attach with wall anchors.
 - 2. Install down clips or cable clips with 1/4 inch anchor on the back rod behind every support bracket.
 - 3. 36 inches o.c. maximum or 24 inches o.c. maximum to suit installation conditions.
- L. Attach pole clips at same elevations as wall clips for a given shelf; use with poles as recommended by manufacturer.
- M. Use corner support brackets on all corner "butt" joints.
- N. For wall to wall installation, use end bracket; drill 1/4 inch holes, and secure with No. 8 pins.

3.3 CLEANING

- A. Upon completion of installation, clean all surfaces that have become soiled during installation.

END OF SECTION 122113

SECTION 122116 - HORIZONTAL LOUVER BLINDS

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. Horizontal louver blinds with faux wood polymer slats.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For horizontal louver blinds, include fabrication and installation details.
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long.
- D. Product Schedule: For horizontal louver blinds. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For horizontal louver blinds with polymer slats that have been tested for compliance with NFPA 701, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For horizontal louver blinds 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. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet-work 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 horizontal louver blinds 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. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.2 HORIZONTAL LOUVER BLINDS, POLYMER SLATS

- A. Basis of Design Manufacturer: SWF Contract.
- B. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- C. Slats: Polymers that are lead free, UV stabilized, integrally colored, opaque, and will not crack or yellow; antistatic, dust-repellent treated.
1. Formulation: Permanently flexible, extruded PVC.
 2. Width: 2 inches.
 3. Thickness: 0.016 inch.
 4. Spacing: Manufacturer's standard.
 5. Profile: Manufacturer's standard.
 6. Features:
- D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrail fully encloses operating mechanisms on three sides and ends.
1. Capacity: One blind per headrail unless otherwise indicated.
 2. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
 - a. Tilt: Full.
 - b. Operator: Clear-plastic wand.
 - c. Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over rotation of gear.
 3. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.
 4. Manual Lift-Operator and Tilt-Operator Locations: Manufacturer's standard.
- E. Bottom Rail: Secures and protects ends of ladders and lift cords.
1. Type: Manufacturer's standard.
- F. Lift Cord: Manufacturer's standard braided cord.
- G. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.
1. Type: Braided cord.
- H. Valance: Manufacturer's standard.
- I. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
1. Type: As indicated.
 2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.
- J. Colors, Textures, Patterns, and Gloss:
1. Slats: White.
 2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated.

2.3 HORIZONTAL LOUVER BLIND FABRICATION

- A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped 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 blind 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 dimension of opening in which blind 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 blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.
- D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish:
 - 1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, 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 installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Locate so exterior slat edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
 - 2. Install mounting and intermediate brackets to prevent deflection of headrails.
 - 3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

- A. Clean horizontal louver blind 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 ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122116

SECTION 122413 - 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 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

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 Verification: For each type of roller shade.

- 1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.

- D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

- C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 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.

1.9 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. Basis-of-Design Product: MechoShade Systems, Inc.; Mecho 5 Manual Roller Shade.

- 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: Clip, jamb mount.
 - 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. Spring Operating Mechanisms: Roller contains spring sized to accommodate shade size indicated. Provide with positive locking mechanism that can stop shade movement at each half-turn of roller and with manufacturer's standard pull.
 - 1. Pole: Manufacturer's standard type in length required to make operation convenient from floor level and with hook for engaging pull.
- C. 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. Direction of Shadeband Roll: Regular, from back of roller.
 - 2. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. 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 4 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 6 inches.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
5. 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. Type: ThermoVeil 1500 or ThermoVeil 1000.
 3. Weave: Mesh.
 4. Roll Width: To suit opening conditions.
 5. Orientation on Shadeband: Railroaded.
 6. Openness Factor: One percent.
 7. 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.
- 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.
 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. 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.

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.

END OF SECTION 122413

SECTION 123530 - RESIDENTIAL CASEWORK

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 kitchen and vanity cabinets.
- B. Related Requirements:
 - 1. Section 123663 "Quartz Agglomerate Countertops."

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Cabinets.
 - 2. Cabinet hardware.
- B. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, and hardware.
- C. Samples for Verification: 8-by-10-inch Samples for each type of finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For casework.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.

- B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

1.6 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

PART 2 - PRODUCTS

2.1 CABINETS

- A. Manufacturer: KCMA Member.
- B. Quality Standard: Provide cabinets that comply with KCMA A161.1.
 - 1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.
- C. Door, Drawer, and Cabinet Construction: Plastic-laminate-faced plywood for exposed surfaces; Grade VGS laminate. Thermoset decorative panels for semi-exposed surfaces. PVC edge molding.
- D. Hinges: Standard heavy-duty steel, concealed 2-way adjustable hinge.
- E. Dovetail Drawers: 5/8 inch thick solid birch hardwood front, back, and sides; dovetail construction of glued and screwed. 1/8 inch hardboard drawer bottoms with maple grained inserted and glued into dado in front, back, and sides. Slab style door fronts.
- F. Door Guides: Epoxy-coated steel, Cushion-Tec, side-mounted guides, self-adjusting in mounting brackets. Built-in stop with 100 lbs. rated load capacity.
- G. Front Frame: 3/4 inch thick kiln-dried solid hardwood. Pocket screw construction frame joinery reinforced with glue and nailed. 1-1/2 inch wide stiles. 3 inch wide mullions. 1-1/2 inch wide rails. Stiles dadoed to receive ends.
- H. End Panels: Nominal 1/2 inch thick wood-based composite panel with matching laminate exterior surfaces. Crystal Maple laminate interiors. End panels inserted into dado in face frame and recessed 3/16 inch.

- I. Hanging Rails: Wall cabinets with 1/2 inch thick by 3-1/2 inch high wood-based composite panel hanging rail running full cabinet width at top and bottom. Base cabinets utilizing same hanging rail at top for full width of cabinet. Tall cabinets utilizing same hanging rail running full cabinet width at top.
- J. Back Panel: 1/8 inch thick hardboard with Maple-grained interior surface. Securely glued and stapled to end panels and hanging rails. Back panels fully captured on wall cabinets.
- K. Shelves: 3/4 inch thick wood-based composite panel with Maple-grained laminate on both faces and matching edge band on facing edges. Shelves adjustable in all standard wall and base cabinets. Center shelf support on all cabinets with center mullions.
- L. Toe Kick: 1/2 inch thick unfinished wood-based composite panel captured between end panels. 4-1/2 inch high toe kick recessed 4-1/2 inches. All base cabinets to receive toe kicks prefinished to match toe kick.
- M. Shoe Mould: Prefinished shoe mould for all base cabinets.
- N. Finish: Furniture quality protective finish system on doors, drawer fronts, front frames, and veneer plywood end panels. Consists of sanding, stain, catalyzed sealer, and catalyzed top coats.

2.2 CABINET MATERIALS

A. General:

- 1. Hardwood Lumber: Kiln dried to 7 percent moisture content.
- 2. Softwood Lumber: Kiln dried to 10 percent moisture content.
- 3. Hardwood Plywood: HPVA HP-1.
- 4. Hardboard: ANSI A135.4, Class 1 Tempered.

B. Exposed Materials:

- 1. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
- 2. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
- 3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.
 - a. Where edges of solid-color plastic-laminate sheets are visible after fabrication, provide through-color plastic laminate.
 - b. For doors and drawer fronts faced with plastic laminate, provide PVC edge molding.
 - c. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.
 - a. Provide material finished on both sides for doors and drawer fronts.
 - b. Provide PVC edge molding on components with exposed or semiexposed edges.
 - c. Colors: As selected by Architect from cabinet manufacturer's full range.
5. PVC Edge Molding: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, and 1 mm thick elsewhere.
 - a. Color: As selected by Architect from cabinet manufacturer's full range.

C. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.
3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.
 - a. For backs of doors and drawer fronts faced with plastic laminate, provide same grade, pattern, color, and texture of plastic laminate as for faces.
 - b. For face frames faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
 - c. For shelves faced with plastic laminate, provide PVC edge molding of 1 mm thick.
 - d. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.
4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.
 - a. Provide material finished on both sides for shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
 - b. Provide PVC edge molding on components with semiexposed edges.
 - c. Colors: As selected by Architect from cabinet manufacturer's full range.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.3 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

- B. Pulls: Back-mounted pulls, 5 inch or 6 inch lengths, similar to P-1906. Finish to match interior design package.
- C. Hinges: Concealed European-style, self-closing hinges.
- D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Install cabinets without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install cabinets level and plumb to a tolerance of 1/8 inch in 8 feet.
- D. Fasten cabinets to adjacent units and to backing.
 - 1. 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 and No. 10 wafer-head sheet metal screws through the metal backing or metal framing behind the wall finish.

3.3 ADJUSTING AND CLEANING

- A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 123530

SECTION 123663 - QUARTZ AGGLOMERATE 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. Quartz agglomerate countertops.
 - 2. Quartz agglomerate backsplashes.
 - 3. Quartz agglomerate end splashes.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
 - 1. Basis of Design Manufacturer: As scheduled on Drawings.
 - 2. Colors and Patterns: As scheduled on Drawings.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Premium.
- B. Configuration:
 - 1. Front: Waterfall edge.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. End Splash: Matching backsplash.
- C. Countertops: 1/2-inch thick, quartz agglomerate with front edge built up with same material.
- D. Backsplashes: 1/2-inch thick, quartz agglomerate. No backsplashes for Kitchen countertops. For bathrooms, provide 3 inch high backsplashes.

- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints: Fabricate countertops without joints.
- G. Joints: Unless otherwise indicated as single-piece units, fabricate countertops in sections for joining in field, with joints at locations indicated.
 - 1. Joint Type: Bonded, 1/32 inch or less in width.
 - 2. Joint Type: Sealant filled, 1/16 inch in width.
- H. Cutouts and Holes: Prepare countertops in shop for field cutting openings for counter-mounted items. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical. Make provisions for sinks with undermount design; sink cutouts to receive a finished and polished edge.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

- 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 quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123663

SECTION 124813 - ENTRANCE FLOOR MATS 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. Roll-up rail mats.
 - 2. Recessed frames.

1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: Assembled sections of floor mat.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform floor load of 300 lbf/sq. ft.
 - 2. Wheel load of 350 lb per wheel.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.2 ROLL-UP RAIL MATS

- A. Basis of Design Product: Balco, Inc.; Model FMR-C: Comparable product by one of the following manufacturers also acceptable:
 - 1. Arden Architectural Specialties, Inc.
 - 2. Construction Specialties.
 - 3. J. L. Industries, Inc.
 - 4. Pawling Corporation; Architectural Products Division.
- B. Roll-up, Aluminum-Rail Hinged Mats: Extruded aluminum tread rails 1-1/2 inches wide by 3/8 inch thick, with slotted or perforated hinges. Provide drainage provisions for exterior mat applications.
 - 1. Tread Inserts: Textured-surface resilient vinyl tread inserts.
 - 2. Colors, Textures, and Patterns of Inserts: As selected by Architect from full range of industry colors.
 - 3. Rail Color: Mill finish.
 - 4. Hinges: Extruded vinyl.
 - 5. Perimeter Filler: Extruded Santoprene.
 - 6. Mat Size: As indicated on Drawings.

2.3 FRAMES

- A. Recessed Frames: Manufacturer's standard extrusion.
 - 1. Extruded Aluminum: ASTM B221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - a. Color: Mill finish.

2.4 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.5 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.6 ALUMINUM FINISHES

- A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
 - 1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
 - 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 142100 - MRL ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes: Electric Traction Elevators.
- B. Products Supplied But Not Installed Under this Section:
 - 1. Hoist Beam.
 - 2. Pit Ladder.
 - 3. Inserts mounted in block walls for rail attachments.
- C. Work Supplied Under Other Sections:
 - 1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
 - 2. Main line disconnects for each elevator.
 - a. One fused three phase permanent power in building electrical distribution room
 - 3. Hoistway ventilation shall be in accordance with local and national building code requirements.
 - 4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
 - 5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
 - 6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
 - 7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
 - 8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.
 - 9. Access Doors: As required for access to governor. Access door shall be self-closing, self-locking if necessary and operable from the inside without a key.

D. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete."
2. Section 055000 "Metal Fabrications."
3. Section 071716 "Composite Sheet Waterproofing."
4. Division 23 - Heating, Ventilating, and Air Conditioning Sections.
5. Division 26 - Electrical Sections.
6. Section 273000 - Voice Communications.
7. Section 283100 - Fire Detection and Alarm.
8. Section 310000 - Earthwork.

E. Reference Standards:

1. ICC/ANSI A117.1: Accessible and Usable Buildings and Facilities.
2. ADAAG: Accessibility Guidelines for Buildings and Facilities.
3. ANSI/NFPA 70: National Electrical Code.
4. ANSI/NFPA 80: Standard for Fire Doors and Fire Windows.
5. ASME/ANSI A17.1: Safety Code for Elevators and Escalators.

1.03 DESCRIPTION OF ELEVATOR

- A. Elevator Equipment: MonoSpace 300 gearless traction elevator.
- B. Equipment Control: KCM831.
- C. Drive: Regenerative.
- D. Quantity of Elevators: Refer to Drawings.
- E. Landings: Refer to Drawings.
- F. Openings: 4 front, 0 rear.
- G. Travel: 31'-0".
- H. Rated Capacity: 3500 lbs. for passenger elevators with clear inside dimensions of 6'-7" width and 6'-2" depth. Single slide doors.
- I. Rated Speed: 150 fpm
- J. Cab Height: 9' 0"
- K. Clear height under suspended ceiling: 8' 6"
- L. Entrance Width and Type: 3' 6" and Left Opening
- M. Entrance Height: 8' 0"
- N. Main Power Supply: 480 Volts + 5%, three-phase.
- O. Operation: Simplex.

- P. Machine Location: Inside the hoistway mounted on car guide rail.
- Q. Control Space Location: Integrated Control System (ICS).
- R. Elevator Equipment shall conform to the requirements of seismic zone: non-seismic.
- S. Maintenance Service Period: 12 months.

1.04 PERFORMANCE REQUIREMENTS

A. Car Performance:

1. Car Speed \pm 5% of contract speed under any loading condition or direction of travel.
2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

B. System Performance:

1. Vertical Vibration (maximum): 15 mg ISO187338/ISO 8041 system pk -pk.
2. Horizontal Vibration (maximum): 12 mg ISO187338/ISO 8041 system pk -pk.
3. Jerk Rate (maximum): 3.3 ft/sec³.
4. Acceleration (maximum) 1.3 ft/sec².
5. In Car Noise: = 55 dB(A).
6. Leveling Accuracy: \pm 0.2 inches.
7. Starts per hour (maximum): 240.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product literature for each proposed system.

1. Cab design, dimensions and layout.
2. Layout, finishes, and accessories and available options.
3. Controls, signals and operating system.
4. Color selection charts for cab and entrances.

B. Shop Drawings:

1. Clearances and travel of car.
2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.

9. Location and details of hoistway door and frames.
 10. Electrical characteristics and connection requirements.
- C. Operation and maintenance data:
1. Provide manufacturer's standard maintenance and operation manual.
- D. Diagnostic Tools:
1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the completed project. During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 15 years of experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.
- B. Installer: The equipment manufacturer shall install the elevator.
- C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

1.07 DELIVERY, STORAGE AND HANDLING

- A. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.
- B. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

1.08 WARRANTY

- A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

1.09 MAINTENANCE SERVICE

- A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.
- B. Maintenance service be performed during regular working hours of regular working days and shall include regular time call back service.
- C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
 - 1. Basis of Design: MonoSpace 300 traction elevators by KONE, Inc.
 - 2. Other acceptable machine room-less products: manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.

2.02 EQUIPMENT - CONTROL COMPONENTS AND CONTROL SPACE

- A. Controller: Provide microcomputer based control system to perform all of the functions.
 - 1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
 - 2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
 - 3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
 - 4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.
- B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.
- C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. One non-fused three phase permanent power in hoist way at top landing. A separate control space should not be required.

2.03 EQUIPMENT: HOISTWAY COMPONENTS

- A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.
- B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.
- C. Buffers, Car and Counterweight: Polyurethane buffer.
- D. Hoistway Operating Devices:
 - 1. Emergency stop switch in the pit.
 - 2. Terminal stopping switches.
 - 3. Emergency stop switch on the machine.
- E. Positioning System: System consisting of magnets and proximity switches.
- F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

2.04 EQUIPMENT: HOISTWAY ENTRANCES

- A. Hoistway Entrances:
 - 1. Sills: Aluminum extruded.

2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

2.05 EQUIPMENT: CAR COMPONENTS

- A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.
- B. Platform: Platform shall be all steel construction.
- C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.
- D. Steel Cab: Manufacturer's standard.
- E. Car Wall Finish:
 1. Rear Wall: Non-removable vertical panels Brushed Stainless Steel.
 2. Side Walls: Non-removable vertical panels Brushed Stainless Steel.
- F. Cab Wall Protection Pads to be included.
- G. Car Skirting Finish: Brushed Stainless Steel.
- H. Car Front Finish: Brushed Stainless Steel.
- I. Car Door Finish: Brushed Stainless Steel.
- J. Ceiling: Round, LED spotlights, Brushed Stainless Steel.
- K. Handrail: Round, straight ends, Brushed Stainless Steel.
 1. Rails to be located on Side Walls of car enclosure.
- L. Threshold: Aluminum.
- M. Flooring: By others. (Not to exceed 6 lbs/sq. ft. and 1/2 inch finished depth.)

N. Emergency Car Signals:

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.
2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.

O. Ventilation: Fan.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

- A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation, and integrated color-display offline media screen. Fixture finish to be: Brushed Stainless Steel
1. Main flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have White illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be White DOT-matrix. All texts, when illuminated, shall be White. The car operating panel shall have a Brushed Stainless Steel finish.
 2. Additional features of car operating panel shall include:
 - a. Car Position Indicator within operating panel (White).
 - b. Elevator Data Plate marked with elevator capacity and car number on car top.
 - c. Help buttons with raised markings.
 - d. In car stop switch per local code.
 - e. Call Cancel Button.
 - f. Integrated color-display offline media screen. 15.6" (39.6 cm) portrait-oriented display to deliver multimedia information to elevator passengers.
- B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a Brushed Stainless Steel.
1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature White illumination.

- C. Car Lantern and Chime: A directional lantern visible from the corridor shall be provided in the car entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down. The car riding lantern face plate shall have a Brushed Stainless Steel finish

2.07 EQUIPMENT - ELEVATOR OPERATION AND CONTROLLER

A. Elevator Operation:

1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
2. Zoned Car Parking.
3. Relative System Response Dispatching.

B. Standard Operating Features to include:

1. Full Collective Operation.
2. Fan and Light Control.
3. Load Weighing Bypass.
4. Ascending Car Uncontrolled Movement Protection
5. Top of Car Inspection Station.

C. Additional Operating Features to include:

1. Independent Service.
2. Hoistway Access Bottom Landing.
3. Hoistway Access Top Landing.
4. Provision for Card Reader in Car (Card Reader provided and Installed by others).

D. Elevator Control System for Inspections and Emergency:

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.
3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

2.08 EQUIPMENT: DOOR OPERATOR AND CONTROL

- A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.
- B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.
- C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.
- D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.
- E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.
- B. Do not proceed with work until unsatisfactory conditions are corrected.
- C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.
- D. Prior to start of Work, verify projections greater than 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.

- E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.
- F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.
- G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.
- H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

3.02 PREPARATION

- A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

3.03 INSTALLATION

- A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.
- B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.
- C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.
- D. Lubricate operating system components in accordance with manufacturer recommendations.
- E. Perform final adjustments, and necessary service prior to substantial completion.

3.04 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
 - 2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.

- a. Ensure adequate support for entrance attachment points at all landings.
- b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
- c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
- d. Coordinate interface of elevators and fire alarm system.
- e. Coordinate interface of dedicated telephone line.
- f. Coordinate the installation of the non-fused three phase permanent power disconnect in hoist way at top landing

3.05 TESTING AND INSPECTIONS

- A. Perform recommended and required testing in accordance with authority having jurisdiction.
- B. Obtain required permits and provide originals to Owner's Representative.

3.06 DEMONSTRATION

- A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION 142100

SECTION 22 05 23 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is a Division-22 Plumbing section, and is a part of each Division-22 section making reference to plumbing system valve specified herein.

1.2 SUMMARY

- A. This Section includes general duty valves common to most mechanical piping systems.
- B. Special purpose valves are specified in individual piping system specifications.
- C. Valve tags and charts are specified in Division-22 Section "Identification for Plumbing Piping and Equipment."

1.3 SUBMITTALS

- A. Product Data: including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Division-22 Section "Basic Plumbing Requirements," under "Product Options."
- B. MSS Standard Practices: Comply with the following standards for valves:
 - 1. MSS SP-45: Bypass and Drain Connection Standard
 - 2. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
 - 3. MSS SP-71: Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - 4. MSS SP-72: Ball Valves with flanged or Butt-Welding ends for General Service
 - 5. MSS SP-78: Cast Iron Plug Valves, Flanged and threaded Ends
 - 6. MSS SP-80: Bronze Gate, Globe Angle and check Valves
 - 7. MSS SP-84: Steel Valves – Socket Welding Threaded Ends
 - 8. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged and Threaded Ends
 - 9. MSS SP-92 MSS Valve User Guide

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation For Transport: Prepare valves for shipping as follows:

- B. Ensure valves are dry and internally protected against rusting and galvanic corrosion.
- C. Protect valve ends against mechanical damage to threads, flange faces, and weld ends preps.
- D. Set valves in best position for handling. Globe and gate valves shall be closed to prevent rattling; ball and plug valves shall be open to minimize exposure of functional surfaces; butterfly valves shall be shipped closed or slightly open; and swing check valves shall be blocked in either closed or open position.
- E. Storage: Use the following precautions during storage:
 - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
- F. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement and protect in watertight enclosures.
- G. Handling: Valves whose size requires handling by crane or lift shall be slung or rigged to avoid damage to exposed valve parts. Handwheels and stems, in particular, shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering valves which may be incorporated in the work include, and are limited to, the following:
 - 1. Grinnell
 - 2. Jenkins
 - 3. Nibco
 - 4. Watts

2.2 VALVE FEATURES

- A. General: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- B. Valve Design: Valves shall have rising stem, or rising outside screw and yoke stems; except, non-rising stem valves may be used where headroom prevents full extension of rising stems.
- C. Pressure and Temperature Ratings: as scheduled and required to suit system pressures and temperatures.
- D. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
- E. Operators: Provide the following special operator features:
 - 1. Handwheels fastened to valve stem, for valves other than quarter turn.
- F. Lever Handle on quarter-turn valves 6 inches and smaller, except for plug valves. Provided one wrench for every 10 plug valves.
- G. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

- H. Bypass and Drain Connections: Comply with MSS- SP-45 bypass and drain connections.
- I. End Connections: as specified in the individual valves specifications.
- J. Threads: Comply with ANSI B2.1.
- K. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
- L. Solder-Joint: Comply with ANSI B16.18.
 - 1. Caution: Where soldered end connections are used, use solder having a melting point below 840 degrees F for gate, globe, and check valves; below 421 degrees F for all valves.

2.3 GATE VALVES

- A. Gate Valves - 2 Inch and Smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.

MANUFACTURER	THREADED		SOLDER	
	NRS	RS	NRS	RS
Grinnell:	3000	3010	3000SJ	3010SJ
Jenkins:	370	47	1240	1242
Nibco:	T113	T-111	S113	S-111
Watts				

- B. Gate Valves - 2 Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use solder end valves for hot water heating or steam piping applications.

MANUFACTURER	THREADED		SOLDER	
	NRS	RS	NRS	RS
Grinnell:	3070	3080	3070SJ	3080SJ
Jenkins:	X	47U	X	X
Nibco:	T-136	T-134	S-136	S-134
Watts				

2.4 BALL VALVES

- A. Ball Valves - 1 Inch and Smaller: rated for 150 psi saturated steam pressure, 400 psi WOG pressure; 2-piece construction, bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low pressure steam.

MANUFACTURER	THREADED	SOLDER
	ENDS	ENDS
Grinnell:	3500	3500SJ

Jenkins:	901T	902T
Nibco:	T-580	S-580
Watts:	B-6000	B-6001

- B. Ball Valves – 1-1/4 Inch to 2 Inch: rated for 150 psi saturated steam pressure, 400 PSI WOG Pressure; 3-piece construction, bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low pressure steam.

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Grinnell:	3800	3800SJ
Nibco:	T-590-Y	S-590-Y
Watts:	B-6800	B-6801

2.5 PLUG VALVES

- A. Plug Valves - 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.
1. Lunkenheimer: 454

2.6 GLOBE VALVES

- A. Globe Valves - 2 Inch and Smaller: MSS SP-80; Class 125, body and screwed bonnet of ASTM B 62 cast bronze, threaded or solder ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Class 150 valves meeting the above shall be used where pressure required.

MANUFACTURER	THREADED	SOLDER
Grinnell:	3210	3210SJ
Jenkins:	746	1200
Nibco:	T-211-Y	S-211-Y
Watts		

- B. Globe Valves - 2 Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel

MANUFACTURER	THREADED
Grinnell:	3240
Jenkins:	106-B
Nibco:	T-235
Watts	

2.7 CHECK VALVES

- A. Swing Check Valves - 2 Inch and Smaller: MSS SP-80; Class 125 cast bronze body and cap conforming to ASTM B 62, horizontal swing, Y-pattern, with a bronze disc, and having threaded or solder ends. Valve shall be capable of being reground while the valve remains in the line. Class 150 valves meeting the above specifications may be used where pressure requires or Class 125 is not available.

THREADED MANUFACTURER	CLASS 125		CLASS 150
	THREADED	SOLDER	
	ENDS	ENDS	ENDS
Grinnell:	3300	3300SJ	3320
Jenkins:	92-A	1222	92-A
Nibco:	T-413	S-413	T-433

- B. Swing Check Valves - 2 Inch and Smaller: MSS SP-80; Class 150, cast bronze body and cap conforming to ASTM B 62, horizontal swing Y-pattern, with a bronze disc, and having threaded ends. Valve shall be capable of being reground while the valve remains in the line.

MANUFACTURER	THREADED
Grinnell:	3320
Jenkins:	92-A
Nibco:	T-433

For grooved connections use valves equivalent to Victaulic Series 712.

- C. Wafer Check Valves - (Non-Slam): Class 250, cast iron body, replaceable lapped bronze seat, lapped and balanced twin bronze flappers and stainless steel trim. Valve shall be designed to open and close at approximately one foot differential pressure. Twin flappers shall be loaded with a stainless steel torsion spring to minimize flapper drag and assure even non-slam checking action.

1. Center Line: CLC.
2. Metraflex: Chexx.
3. Stockham: WG970.

- D. Lift Check Valves 2 Inch and Smaller: Class 125, cast bronze body and cap conforming to ASTM B 62, horizontal pattern, lift type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Valve shall be capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL
Jenkins:	655-A
Lunkenheimer:	233

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.

- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which it was shipped.
- C. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.

3.2 VALVE SELECTION

- A. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:
- B. Copper Tube Size 2 Inch and Smaller: Solder ends, except in heating hot water shall have threaded ends.

3.3 VALVE INSTALLATIONS

- A. General Application: Use ball valves for shut-off duty. Refer to piping system specification sections for specific valve applications and arrangements.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down.

3.4 SOLDER CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube of depth of valve socket, using steel wool, sand cloth, or a steel wire brush to a bright finish.
- C. Clean valve socket in same manner. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Insert tube into valve socket making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to insure even distribution of the flux.
- E. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating the valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush

3.5 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads.

- D. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.6 FLANGED CONNECTIONS

- A. Align flanges surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.
- C. For dead end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.7 FIELD QUALITY CONTROL

- A. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.

3.8 ADJUSTING AND CLEANING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive finish painting or insulation.

3.9 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

VALVES 2 INCH AND SMALLER

SERVICE CHECK	GATE	GLOBE	BALL
Domestic Hot and Cold Water 125	125	125	150

VALVES 2-1/2 INCH AND LARGER

SERVICE CHECK	GATE	GLOBE	BALL
Domestic hot and Cold Water 125	125	125	200

END OF SECTION 22-05-23

SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is Division-22 Plumbing section, and is part of each Division-22 section making reference to supports and anchors specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-22 sections
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials
 - 7. Anchors.
 - 8. Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years
- B. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
- C. UL and FM Compliance: Provide products which are UL-listed and FM approved.
- D. MSS Standard Compliance:
 - 1. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - 2. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - 3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - 4. Terminology used in this section is defined in MSS SP- 90.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, for each type of support and anchor. The manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, etc. for each piece and groups of pipes. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components. Details for steel frames to be used in connection with the isolations and seismic restraint of the items.

PART 2 - PRODUCTS

2.1 HORIZONTAL – PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory- fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal- piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - 1. Adjustable Steel Clevis Hangers: MSS Type 1 (Grinnell Fig. 260).
 - 2. Steel Pipe Clamps: MSS Type 4 (Grinnell Fig. 212).
 - 3. Adjustable Swivel Pipe Rings: MSS Type 6 (Grinnell Fig. 104).
 - 4. Split Pipe Rings: MSS Type 11 (Grinnell Fig. 108).
 - 5. U-Bolts: MSS Type 24 (Grinnell Fig. 137).
 - 6. Clips: MSS Type 24 (Grinnell Fig. 262).
 - 7. Adjustable Pipe Saddle Supports: MSS Type 38 (Grinnell Fig. 264), including steel pipe base support and cast-iron floor flange.
 - 8. Single Pipe Rolls: MSS Type 41 (Grinnell Fig. 171).
 - 9. Adjustable Roller Hangers: MSS Type 43 (Grinnell Fig. 174).

2.2 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
 - 1. Two-Bolt Riser Clamps: MSS Type 8.
 - 2. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-ROD ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product

information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

1. Steel Turnbuckles: MSS Type 13.
2. Steel Clevises: MSS Type 14.
3. Swivel Turnbuckles: MSS Type 15.
4. Malleable iron Sockets: MSS Type 16.
5. Steel Weldless Eye Nuts: MSS Type 17.

2.4 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

2.5 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory- fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, and are limited to, the following:
 1. Elcen metal products Co.
 2. Fee & Mason Mfg. Co., Div. Figgie International.
 3. ITT Grinnel Corp.

2.7 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi- steel or heavy fabricated steel, consisting of bolted two- section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use waffle or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as install for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.5 PROVISIONS FOR MOVEMENT

- A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- B. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- C. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- D. Insulated Piping: Comply with the following installation requirements.
- E. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- F. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.
- G. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.6 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.7 EQUIPMENT SUPPORTS

- A. Concrete housekeeping bases will be provided as work of Architectural Divisions. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.
- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.8 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 05 29

SECTION 22 07 00 – PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is Division-22 Plumbing section, and is part of each Division-22 section making reference to plumbing insulation specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of plumbing insulation required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of plumbing insulation specified in this section include the following:
 - 1. Insulation of piping, tanks, fittings, and other surfaces.
- C. Piping System Insulation:
 - 1. Fiberglass Piping Insulation.
 - 2. Cellular Glass
 - 3. Flexible Unicellular
 - 4. Cellular Phenolic Foam
- D. Underground piping installation is not part of this section.
- E. Refer to Division-22 section "Hangers and Supports for Plumbing Piping and Equipment" for protection saddles, protection shields, and thermal hanger shields; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years successful installation experience on projects with plumbing insulation similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite plumbing insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- D. Energy Efficiency Code Compliance: Comply with applicable sections of Florida Building Code Sixth Edition (2017) - Energy Conservation, in regard to insulation of piping, duct, and mechanical equipment.

- E. Insulation material: Insulation materials must be manufactured at facilities certified and registered with an approved registrar to conform to ISO 9000 quality standard.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of piping insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each piping system requiring insulation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, and are limited to, the following.
 1. Armstrong World Industries, Inc.
 2. Knauf Fiber Glass GmbH.
 3. Johns-Manville Products Corp.
 4. Owens-Corning Fiberglas Corp.
 5. Pittsburgh Corning Corp.
 6. Rubatex Corp.

2.2 PIPING INSULATION MATERIALS

- A. Fiberglass Piping Insulation: ASTM C547, Class 1, with kraft reinforced foil vapor barrier jacketing
- B. Cellular Glass Piping Insulation: ASTM C 552, Type II, Class 2. Preformed split sectional pipe insulation of rigid foamed cellular glass for piping and flat block formed to fit for equipment. Apply with all joints tightly butted and buttered with joint sealer. Secure in place with tape, twelve inches on center, secured with at least two points per section. Cover outdoor insulation with one-eighth inch layer of white fire-retardant vapor-barrier mastic; apply layer of white open weave glass fabric (10" x 20" mesh) with all joints overlapped two inches, and cover with second one-eighth inch layer of same mastic or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM-E84 flame spread and smoke develop. Indoor insulation may be covered with factory-applied white fire-retardant foil-scrim-kraft all purpose jacket or VentureClad 1577CW-embossed 5-ply self-adhesive vapor barrier/weather proofing membrane with a permeance of 0.0000 when tested per ASTM-E-96; exceeds both UL-723 and ASTM E84 flame spread and smoke develop.

- C. Flexible Unicellular Piping Insulation (Armaflex): ASTM C 534, Type I. Preformed split sectional closed-cell pipe insulation. Suitable for operating temperatures of -40°F to +220°F. Thermal conductivity "K" factor of 0.27.
- D. Cellular phenolic Foam Pipe Insulation, ASTM C 1124 Type III with Kraft reinforced foil vapor barrier.
- E. Jackets for Piping Insulation: ASTM C 921, Type I.
 - 1. Type A: Smooth or embossed aluminum jacket, 0.016" minimum thickness secured with Y2-inch aluminum bands, for all exterior installations.
 - 2. Type C: PVC plastic, Zeston 2000, one-piece molded-type fitting covers and Jacketing material, gloss-white.
 - 3. Type D: White or embossed, self-adhesive jacket: VentureClad 5-ply laminate for exterior installations.
- F. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- G. Fittings: Provide fitting coverings of a similar material and thickness as adjacent pipe coverings. Cover all elbows, tees, valves, flanges and other fittings of piping system.
- H. Accessories: All staples, bands, wires, adhesives, cements, sealers and protective finishes to be as recommended by insulation manufacturers.

2.3 EQUIPMENT INSULATION MATERIALS

- A. Rigid Fiberglass Equipment Insulation: ASTM C612, Class II, 3.0 pcf density, with reinforced foil kraft vapor barrier facing.
- B. Cellular Glass Insulation: Preformed flat block cut for equipment with factory applied all service jacket, or Pittcote 404 with PC79 fabric or VentureClad I577CW-embossed 5-ply self adhesive vapor barrier/weather proofing membrane.
- C. Flexible Fiberglass Equipment Insulation: Not acceptable.
- D. Flexible Unicellular Equipment Insulation: ASTM C 534, Type II. Closed-cell insulation suitable for operating temperatures of -40°F to +220°F. Exterior applications, apply VentureClad I577CW - white, highly UV resistant.
- E. High Temperature Insulation: Calcium-silicate insulation, suitable for up to 1200°F service, K factor of 0.49 at 600°F, and density of 14½ pounds per cubic foot. Apply VentureClad I577CW - white, on interior/exterior hot lines.
- F. Cellular phenolic Foam Pipe Insulation, ASTM C 1124 Type I grade I with Kraft reinforced foil vapor barrier.
- G. Equipment Insulation Compounds: Provide accessories (staples, bands, wire, etc.) and compounds (adhesives, cements, sealers, mastics, protective finishes, etc.) as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which plumbing insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PLUMBING PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre insulated equipment.
- B. Insulate potable chilled water piping and roof drains and ten feet of connecting drain line with ½-inch flexible Unicellular; VentureClad 1577CW - white for exterior applications.
- C. Potable Hot Piping:
 - 1. Insulate potable hot water piping and potable hot water recirculating piping with not less than 1-inch of insulation having a conductivity not exceeding 0.27 BTUH X ft² X °F. one of the following types and thicknesses of insulation for circulating mains and runouts. Jacket material shall be VentureClad 1577CW white for exterior applications.
- D. Flexible Unicellular: Non-circulating runouts, not to exceed ten feet in length for all temperature ranges above, 1-inch thick insulation for pipe sizes up to one inch.

Pipe Size	100°F - 160°F	161°F - 200°F
Up to 1"	1"	1"
1½" and up	1½"	1½"

3.3 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Protect outdoor insulation from weather or ultraviolet deterioration by installing outdoor protective finish or jacketing; VentureClad 1577WC – White, UV resistant.
- F. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

- G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply three inch (3") wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with three inch (3") wide vapor barrier tape or band. VentureClad butt strip tape, finish includes white and embossed (permeance 0.0000) or equal.
- J. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

3.4 EXISTING INSULATION REPAIR

- A. Repair or replace damaged sections of existing plumbing insulation, including units with vapor barrier damage and moisture saturated units both previously damaged and/or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 07 00

SECTION 22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is a Division-22 Plumbing section, and is a part of each Division-22 section making reference to pipe, tube, and fittings specified herein.

1.2 DESCRIPTION OF WORK

- A. This Section specifies the domestic water piping system, including potable cold, hot, recirculated hot water piping, fittings, and specialties within the building to a point five feet (5'-0") outside the building. Extent of domestic water systems required by this section is indicated on drawings and/or specified in other Division-22 sections.
- B. Trenching and backfill required in conjunction with potable water piping is specified in other Division-22 sections, and is included as work of this section.
- C. Products installed but not furnished under this Section include water meters which will be provided by others, to the site, ready for installation.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of domestic water systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: A firm with at least five (5) years of successful installation experience on projects with domestic water system work similar to that required for project.
- C. Codes and Standards:
 - 1. Plumbing Code Compliance: Comply with applicable portions of Florida Building Code Sixth Edition (2017) - Plumbing pertaining to selection and installation of plumbing materials and products

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for domestic water systems materials and products (i.e. water hammer arresters, valves, hydrants, backflow preventors, pressure-temperature relief valves, etc.).
- B. Shop Drawings: Submit scaled layout drawings of potable water piping and fittings including, but not necessarily limited to, pipe and tube sizes, locations, elevations and slopes of horizontal runs, wall and

floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

- C. Record Drawings: At project closeout, submit record drawings of installed potable water systems piping and piping products, in accordance with requirements of Division 1.
- D. Maintenance Data: Submit maintenance data and parts lists for potable water and toilet flushing systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated on plans and in Division-22 Plumbing Sections and complying with Florida Building Code Sixth Edition (2017) - Plumbing. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.

2.2 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipes and pipe fittings complying with Division-22 Plumbing Sections, in accordance with the following listing:
- B. Piping within Building (except below slab):
- C. Pipe Size 2" and Smaller: Chlorinated Polyvinyl chloride pipe (CPVC); tubing sizing of Flowguard Gold or equal. CPVC piping and fittings shall conform to ASTM D2846. CPVC Solvent cement shall conform to ASTM F493.
- D. Pipe Size 2 ½" and larger: Chlorinated Polyvinyl chloride pipe (CPVC); tubing sizing of Corzan or equal. CPVC piping and fittings shall conform to ASTM F441. Fittings shall conform to ASTM F437 for schedule 80 threaded and ASTM F439 for schedule 80 socket. CPVC Solvent cement shall conform to ASTM F493.
- E. The installation of copper tubing shall not be permitted without the approval of Owner and Engineer of Record. Where copper tubing is approved by the Owner and Engineer of Record not the following: Pipe Sizes 4" and smaller: Copper tubing, conform to ASTM B88, Type K, hard temper, copper tube, ANSI B16.22 streamlined pattern wrought-copper fitting, soldered joints using 95-5 tin-antimony solder.
- F. All exposed copper tube shall be chrome plated.
 - 1. Piping inside and outside Building, below ground: Pipe Size 2" and Smaller: Chlorinated Polyvinyl chloride pipe (CPVC); tubing sizing of Flowguard Gold or equal. CPVC piping and fittings shall conform to ASTM D2846. CPVC Solvent cement shall conform to ASTM F493.
 - 2. Pipe Size 2 ½" and larger: Chlorinated Polyvinyl chloride pipe (CPVC); tubing sizing of Corzan or equal. CPVC piping and fittings shall conform to ASTM F441. Fittings shall conform to ASTM F437 for schedule 80 threaded and ASTM F439 for schedule 80 socket. CPVC Solvent cement shall conform to ASTM F493.

3. Pipe Sizes 4" and smaller: Copper tubing. Conform to ASTM B88, Type K, and soft temper copper tube. All joints below ground are to be silver brazed.
- G. Balance Cocks, Soldered Ends 2" and smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern. Acceptable manufactures include:
 1. American Air Filter Co.
 2. Bell & Gossett ITT (Fluid Handling Division)
 3. Hammond Valve Corp.
 4. Milwaukee Valve Co., Inc.
 5. Spirax Sarco USA
 6. Taco, Inc.
- H. Hose Bibbs: Bronze body, renewable composition disc, tee handle, three-fourths inch (3/4") NPT inlet, 3/4" hose outlet, vacuum breaker. Acceptable manufacturers for hose bibs and faucets include:
 1. Hammond Valve Corp.
 2. Nibco Inc.
 3. Watts Regulator Co.
 4. Woodford (WCM Industries, Inc)
- I. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes. Combined pressure-temperature relief valves shall be bronze body with test lever and thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi; suit wall thickness. Acceptable manufactures include:
 1. Combraco Industries, Inc.
 2. Watts Regulator Co.
 3. Zurn Industries Inc. (Wilkins-Regulator Division)
- J. Hydrants: Acceptable manufacturers include:
 1. Josam Mfg. Co.
 2. Jay R Smith Mfg. Co.
 3. Woodford (WCM Industries, Inc.)
 4. Zurn Industries Inc. (Hydromechanics Division)
- K. Backflow Preventers: Acceptable manufacturers include:
 1. Febco Sales, Inc. (Sub. of Charles M. Bailey Co., Inc.
 2. Hersey Products, Inc.
 3. ITT Lawler (Fluid Handling Division)
 4. Watts Regulator Co.
- L. Water Hammer Arrestors: Provide Plumbing and Draining Institute types A, B, C, D, E, and F. Acceptable manufacturers include:
 1. Josam Mfg. Co.
 2. Jay R Smith Mfg. Co.
 3. Zurn Industries Inc. (Wilkins-Regulator Division)
 4. Precision Plumbing Products

2.3 BASIC IDENTIFICATION

- A. General: Provide identification complying with the Florida Building Code Sixth Edition (2017) - Plumbing, Florida Administrative Code, and Division-22 Plumbing Sections, in accordance with the following listing:

- B. Potable Cold Water Piping: Self-adhesive pipe marker conforming to ASME A13.1 requirements and indicating direction of flow.
- C. Potable Hot Water Piping: Self-adhesive pipe marker conforming to ASME A13.1 requirements and indicating direction of flow.
- D. Water Service: Underground-type plastic line markers.
- E. Potable Water Valves: Brass valve tags.

2.4 BASIC PIPING SPECIALTIES

- A. General: Provide piping specialties complying with Division-22 Plumbing Sections, in accordance with the following listing:
 - 1. Pipe escutcheons.
 - 2. Dielectric unions.

2.5 BASIC SUPPORTS AND ANCHORS

- A. General: Provide supports and anchors complying with Division-22 Plumbing Sections, in accordance with the following listing:
- B. Adjustable steel clevises and adjustable pipe saddle supports for horizontal piping hangers and supports.
- C. Two-bolt riser clamps for vertical piping supports.
- D. Concrete inserts, C-clamps, and steel brackets for building attachments. Protection shields for insulated piping support in hangers.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Verify all dimensions by field measurements. Verify that all water distributions piping is installed in accordance with pertinent codes and regulations, and reference standards. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation. Coordinate pipe sleeve locations with other disciplines. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF BASIC IDENTIFICATION

- A. General: Install mechanical identification in accordance with Division-22 Plumbing Sections.

3.3 INSTALLATION OF POTABLE WATER DISTRIBUTION PIPING

- A. General: Install water distribution piping in accordance with Division-22 Plumbing Sections.

- B. Install piping with 1/32" per foot (1/4%) downward slope towards drain point.
- C. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 INSTALLATION OF EXTERIOR WATER PIPING

- A. General: Install exterior water service piping system in compliance with local governing regulations.
- B. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide shutoff valve at water service entry inside building.
- C. Copper Tube: Install in accordance with recommended procedures of the Copper Development Association.

3.5 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Division-22 Plumbing Sections.

3.6 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports, anchors, and seals in accordance with Division-22 Plumbing Sections.

3.7 INSTALLATION OF VALVES

- A. Install valves in accordance with Division-22 Plumbing Sections.
 - 1. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two (2) or more plumbing fixtures or equipment connections, and elsewhere as indicated.
 - a. For sectional shutoff valves 2" and smaller, use gate or ball valves; for sectional shutoff valve 2½" and larger, use gate or butterfly.
 - 2. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
 - a. For shutoff valves 2" and smaller, use gate or ball valves; for sectional shutoff valve 2½" and larger, use gate or butterfly.
 - 3. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.
 - a. For shutoff valves 2" and smaller, use gate or ball valves; for sectional shutoff valve 2½" and larger, use gate or butterfly.
 - 4. Install balance cocks in each hot water recirculating loop, discharge side of each pump, and elsewhere as indicated
- B. Hose Bibbs: Install on exposed piping where indicated with vacuum breaker.
- C. Hydrants: Installed where indicated, in accordance with manufacturer's installation instructions.
 - 1. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed

- D. Install water hammer arresters in locations required by Plumbing Code and as recommended by manufacturers.

3.8 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes and indicated, but in no case smaller than required by Florida Building Code Sixth Edition (2017) - Plumbing.
- B. Plumbing Equipment Connections: Connect hot and cold water piping system to plumbing equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.9 FIELD QUALITY CONTROL

- A. Do not enclose, cover, or put into operation any new, extended, or replaced water distribution piping system until it has been inspected, tested and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing and approval must be uncovered. Notify the plumbing official have jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by plumbing official. If the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection.
 - 1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - 2. Final Inspection: Arrange for a final inspection by the plumbing to observe the tests specified below and to insure compliance with the requirements of the Plumbing Code.
- B. All new water distribution piping systems which have been altered, extended or repaired for leaks and defects must be tested. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 1. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system material. Isolate the test source and allow to stand for a period of four hours. Leaks and loss in test pressure constitute defects which must be repaired using new materials. Retest system until satisfactory results are obtained.
- C. Piping Tests: Test potable water piping in accordance with testing requirements of Division-22 Plumbing Sections

3.10 ADJUSTING AND CLEANING

- A. Cleaning, Flushing, and Inspecting: Clean, flush, and inspect potable water systems in accordance with requirements of Division-22 Plumbing Sections.
- B. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use. Prepare reports for all purging and disinfecting activities.
- C. Disinfection: Disinfect potable water system in accordance with Florida Building Code - Plumbing. Disinfect water service line in accordance with AWWA C601 or AWWA D105, or as described below:
 - 1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet

2. Fill the system to be tested, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate and allow to stand for 24 hours.
3. Drain the system of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine; isolate and allow to stand for three hours.
4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.
5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

END OF SECTION 22 11 16

SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is Division-22 Plumbing section, and is part of each Division-22 section making reference to piping specialties specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons.
 - 2. Dielectric Unions.
 - 3. Fire Barrier Penetration Seals.
 - 4. Water Hammer Arresters.
 - 5. Drip Pans.
 - 6. Pipe Sleeves.
 - 7. Sleeve Seals.
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in Division-22 Plumbing sections.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 PIPING SPECIALTIES

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide solid chrome plated brass escutcheons, manufacturers offering pipe escutcheons which may be incorporated in the work include; but are not limited to, the following:
 - 1. Chicago Specialty Mfg. Co.
 - 2. Producers Specialty & Mfg. Corp.
 - 3. Sanitary-Dash Mfg. Co.

2.3 DIELECTRIC UNIONS

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include; and are limited to, the following:
 - 1. B & K Industries, Inc.
 - 2. Capital Mfg. Co.; Div. of Harsco Corp.
 - 3. Eclipse, Inc.
 - 4. Epcos Sales, Inc.
 - 5. Perfection Corp.
 - 6. Rockford-Eclipse Div.
 - 7. Watts Regulator Co.

2.4 WATER HAMMER ARRESTERS

- A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering water hammer arresters which may be incorporated in the work include; and are limited to, the following:
1. Amtrol, Inc.
 2. Smith (Jay R.) Mfg. Co.
 3. Zurn Industries, Inc.; Hydromechanics Div.
 4. Watts Regulator Co.

2.5 FABRICATED PIPING SPECIALTIES

- A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2- 1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket and flange at low point for watertight joint and 1" drain line connection.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:
- C. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.
- D. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
- E. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
- F. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- G. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

- A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.
- B. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that

pipng and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

- C. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.

END OF SECTION 22 11 19

SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is Division-22 Plumbing section, and is part of each Division-22 section making reference to sanitary, waste and vent piping specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of soil, waste and vent systems work, is indicated on drawings and schedules, and by requirements Division-22 sections.
- B. Refer to appropriate Division-22 Plumbing sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.
- C. Trenching and backfilling required in conjunction with underground building drain piping is specified in applicable Division-22 Plumbing sections, and is included as work of this section.
- D. Refer to Divisions-1 section for flashings required in conjunction with soil, waste and vent systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacturer of soil and waste systems products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects with soil, waste and vent systems work similar to that required for project.
- C. Codes and Standards:
 - 1. Plumbing Code Compliance: Comply with applicable portions of Florida Building Code Sixth Edition (2017) - Plumbing pertaining to plumbing materials, construction and installation of products.
 - 2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.
 - 3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.
 - 4. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for soil and waste systems materials and products.
- B. Coordination Drawings: Prepare and submit coordination drawings for Drainage and Vent piping.
- C. Shop Drawings: Submit scaled layout drawings of soil and waste pipe and fittings including, but not necessarily limited to, pipe sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.
- D. Record Drawings: At project closeout, submit record drawings of installed soil and waste systems, in accordance with requirements of Division-1 sections.
- E. Quality Control Submittals: Submit reports specified in Part 3 of the Section.
- F. Maintenance Data: Submit maintenance data and parts lists for soil and waste systems materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1 sections.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of all drains and associated materials, such as flashing, with other work such as roofing, concrete slabs and sanitary storm sewers to ensure proper interface with all project components.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems.

2.2 ACCEPTABLE MANUFACTURERS

- A. Manufacturers offering products which may be incorporated in the work include:
 - 1. Josam Mfg. Co.
 - 2. Jay R. Smith Mfg. Co.
 - 3. Zurn Industries Inc. (Hydromechanics Division)

2.3 BASIC PIPES AND PIPE FITTINGS

- A. General: Provide pipes and pipe fittings complying with Division-22 Plumbing Sections, in accordance with the following listing:

1. Above Ground Soil, Waste, and Vent Piping:
 - a. Polyvinyl chloride sewer pipe (PVC) DWV; Schedule 40 pipe and socket fittings, conforming to ASTM D1785 and ASTM D-2665. Fittings shall conform to ASTM D2665. Pipe cement shall be PVC solvent cement conforming to ASTM D2564.
 - b. Polyvinyl chloride plastic pipe (PVC); Type DWV; PVC plastic type DWV socket-type fittings, solvent cement joints.
2. Underground Building Drain Piping:
 - a. Pipe 8" and Smaller: Polyvinyl chloride sewer pipe (PVC) DWV; Schedule 40 pipe and socket fittings, conforming to ASTM D1785 and ASTM D-2665. Fittings shall conform to ASTM D2665. Pipe cement shall be PVC solvent cement conforming to ASTM D2564.

2.4 DRAINAGE PIPING SPECIALTIES

- A. Trap Primers: Lavatory / sink type overflow type, with ½" connections matching piping system.
- B. Cleanout Plugs: Cast-bronze or brass, threads complying and ANSI B2.1, countersunk head.
- C. Floor Cleanouts: Heavy-duty rated cast-iron body and frame, with cleanout plug an adjustable round nickel bronze top, manufacturer's standard cast unit, exposed rim type, with recess to receive 1/8" thick resilient floor finish.
- D. Cast-iron Top: Manufacturer's standard cast unit, exposed flush type, with standard mill finish.
- E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.
- F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.
- G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stack, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- H. Vandal-proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

2.5 BASIC SUPPORTS AND ANCHORS

- A. General: Provide supports and anchors complying with Division-22 Plumbing Sections, in accordance with the following listing:
 1. Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.
 2. Two-bolt riser clamps for vertical piping supports.
 3. Concrete inserts, C-clamps, and steel brackets for building attachments.

2.6 FLOOR DRAINS

- A. General: Provide floor drains and sinks of sizes and features as indicated on drawings.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrates and conditions under which soil and waste systems are to be installed. Verify all dimensions by field measurements. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the indicated design, the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation. Examine wall, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 FOUNDATION PREPARATION FOR UNDERGROUND BUILDING DRAINS

- A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
- B. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamper sand backfill at each pipe bell hole.

3.3 INSTALLATION OF BASIC IDENTIFICATION

- A. General: Install mechanical identification in accordance with Division-22 Plumbing Sections.

3.4 INSTALLATION OF ABOVE GROUND PIPING

- A. General: Install soil and waste piping in accordance with Division-22 Plumbing Sections, and with Florida Building Code Sixth Edition (2017) - Plumbing.
- B. Copper Tubing: Where copper tubing is approved for use by Owner and Engineer of Record, solder joints in accordance with the procedures specified in ANSI B9.1.
- C. PVC Pipe: The pipe and socket must be leaned, burrs removed, primed, and solvent applied to both. They must be assembled quickly and twisted one-quarter turn to spread the solvent.
- D. Make changes in direction of drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where tow fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipe and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

3.5 INSTALLATION OF BUILDING DRAIN PIPING

- A. General: Install underground building drains as indicated and in accordance with Florida Building Code Sixth Edition (2017) - Plumbing. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed. Clean interior of piping of dirt and other superfluous material as work progresses. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- B. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 2 1/2" and smaller, and 1/8" per foot (1%) for piping 3" through 6", and 1/16" per foot (0.5%) 8" and larger.
- C. Extend building drain to connect to site sewer piping.
- D. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.
- E. Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the Florida Building Code Sixth Edition (2017) - Plumbing. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.6 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Division-22 Plumbing Sections.

3.7 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports and anchors in accordance with Division-22 Plumbing Sections.

3.8 INSTALLATION OF DRAINAGE PIPING PRODUCTS

- A. Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Florida Building Code Sixth Edition (2017) - Plumbing.
- B. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.9 INSTALLATION OF FLOOR DRAINS

- A. General: Install floor drains in accordance with manufacturer's written instructions at low point of surface areas to be drained or indicated. Set tops of drains flush with finish floor. Position drains so that they are accessible and easy to maintain. Trap all drains connected to the sanitary sewer.

- B. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

DEPRESSION	RADIUS OF AREA DRAINED
1/2"	5'-0"
3/4"	10'-0"
1"	15'-0"
1 1/4"	20'-0"
1 1/2"	25'-0"

- C. Coordinate flashing work with work of waterproofing and adjoining substrate work.
- D. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.
- E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

3.10 INSTALLATION OF TRAP PRIMERS

- A. General: Install trap primes in accordance with manufacturer's written instructions and in locations indicated.

3.11 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by Florida Building Code Sixth Edition (2017) - Plumbing.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Test soil and waste piping system in accordance with requirements of Florida Building Code Sixth Edition (2017) - Plumbing.
- B. Do not enclose, cover, or put into operation any new, extended, or replaced drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction. Work which has been concealed prior to inspection, testing, and approval must be uncovered. Notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Prepare inspection reports, signed by the plumbing official.
1. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 2. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and insure compliance with the requirements of the plumbing code.
 3. If piping system fails to pass the test or inspection, make the required corrections, and arranged for reinspection.

- C. Test for leaks and defects all new drainage and vent piping systems and parts of existing system, which have been altered, extended or repaired. Perform tests in the presence of the plumbing official. Prepare reports for all tests and required corrective action. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
 - 2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

- D. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

3.13 ADJUSTING AND CLEANING

- A. Clean drain strainers, domes, traps, and interior of piping. Remove dirt and debris as work progresses.
- B. Clean flush, and inspect soil and waste piping in accordance with requirements of Division-22 Plumbing Sections.

3.14 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with construction materials and debris, and to prevent damage from traffic and construction work.

END OF SECTION 22 13 16

SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions and Contract, including General and Supplementary Conditions and Architectural Division Specification sections, apply to work of this section.
- B. This section is Division-22 Plumbing section, and is part of each Division-22 section making reference to plumbing fixtures specified herein.

1.2 DESCRIPTION OF WORK

- A. This Section specifies general installation requirements for plumbing fixtures and specific requirements for fittings, trim, and accessories. Refer to plumbing drawings and Plumbing Fixture and Connection Schedule and this Section for fixture requirements.
- B. Types of plumbing fixtures required for the project include the following:
 - 1. Lavatories.
 - 2. Service sinks.
 - 3. Sinks
 - 4. Urinals.
 - 5. Water closets.
 - 6. Water coolers.

1.3 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacture of plumbing fixtures of the type, style and configuration required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Codes and Standards:
 - 1. Plumbing Fixture Standards: Comply with applicable portions of Florida Building Code Sixth Edition (2017) - Plumbing pertaining to materials and installation of plumbing fixtures.
 - 2. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bath tub units.
 - 3. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
 - 4. Federal Standards: Comply with applicable FS WW-P-541/- Series sections pertaining in plumbing fixtures.
 - 5. NAHB Label: Provide fiberglass bath tub units and shower stalls which have been tested and labeled by NAHB Research Foundation Inc.
 - 6. UL Compliance: Construct water coolers in accordance with UL Standard 399 "Drinking-Water Coolers", and provide UL- listing and label.
 - 7. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems".

8. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.
9. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".
10. Comply with Chapter 553, Part V, Florida Statutes, "Accessibility by Handicapped Persons".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.
- B. Shop Drawings: Submit manufacturer's rough-in drawings, details dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with other trades as required for installation. Furnish templates as necessary.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.
- D. Color Charts: Submit manufacturer's standard color charts for cabinet finishes and fixture colors.
- E. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble- shooting" maintenance guide. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver plumbing fixtures individually wrapped in factory fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.
- C. Quality Control Submittals: Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards and with performance verification requirements specified in this Section.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.2 MATERIALS

- A. General: Unless otherwise specified, comply with applicable Federal Specification WW-P-541/Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with requirements of WW-P-541/specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541/.
- B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- D. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper.
- E. Finish: No. 4, bright, directional polish on exposed surfaces.
- F. Steel Sheet for Baked Enamel Finish: ASTM A 591, coating Class C, galvanized-bonderized.
- G. Steel Sheet for Porcelain Enamel Finish: ASTM A 424, commercial quality, Type I.
- H. Galvanized Steel Sheet: ASTM A 526, except ASTM A 527 for extensive forming; ASTM A 525, G90 zinc coating, chemical treatment. Aluminum: ASTM B 209/B 221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.
- I. Plastic Laminate: NEMA LD3, general purpose high pressure type, 0.050" thick, smooth (non-textured) white unless another texture and color are indicated or selected by Architect/Engineer.
- J. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- K. Fiberglass: ANSI Z124, smooth surfaced, with color selected by Architect/Engineer.
- L. Synthetic Stone: High quality, free form defects, glaze on exposed surfaces, stain resistant.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

- A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. Supplies and Stops for Lavatories and Sinks: Polished chrome-plated loose-keyed angle stop having ½" inlet and 3/8" O.D. by 12" long flexible tubing outlet, and wall flange and escutcheon. Insulate the trap and hot water supply for handicapped lavatories with insulation kit.
- C. Supplies and Stops for Water Closets: Polished chrome-plated, loose-keyed angle stop having ½" inlet and 3/8" O.D. by 12" long flexible tubing outlet with collar, and wall flange and escutcheon.

- D. Traps: Cast brass, 1¼” and 1½” adjustable “P” trap with cleanout and waste to wall. All connections at wall shall be slip joint type.
- E. Tub Waste and Overflow Fittings: Concealed lever operated pop-up bath waste and overflow; chrome plated waste spud with universal type outlet connection suitable for 1½” I.P.S., or 1½” solder-joint outlet connection on waste tee.
- F. Escutcheons: Chrome-plated cast brass with set screw.
- G. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.
- H. Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as indicated.
- I. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- J. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.
- K. Comply with additional fixture requirements contained in fixture schedule attached to this section.

2.4 ACCEPTABLE MAUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plumbing fixtures which may be incorporated in the work include, and are limited to, the following:
 - 1. Plumbing Fixtures:
 - a. As specified on the contract documents.
 - b. American Standard.
 - c. Kohler.
 - d. Gerber
 - e. Sloan
 - 2. Plumbing Trim:
 - a. As specified on the contract documents.
 - 3. Flush Valves:
 - a. As specified on the contract documents.
 - 4. Fixture Seats:
 - a. As specified on the contract documents.
 - 5. Water Coolers:
 - a. As specified on the contract documents.
 - b. Elkay
 - c. Halsey-Taylor
 - d. Haws Corp.
 - 6. Service Sinks:
 - a. As specified on the contract documents.
 - 7. Drains:
 - a. As specified on the contract documents.
 - 8. Hose Bibbs:
 - a. As specified on the contract documents.
 - 9. Fixture Carriers:
 - a. Josam Mfg. Co.
 - b. Kohler Co.
 - c. Zurn Industries, Inc.; Hydromechanics Div.

- d. Watts Regulator Co.
- e. Jay. R. Smith Mfg. Co.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine walls, floors, substrates, and cabinets for suitable conditions where fixtures are to be installed. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PLUMBING FIXTURES

- A. General: Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Florida Building Code Sixth Edition (2017) - Plumbing, pertaining to installation of plumbing fixtures, and ANSI A117.1 and Public Law 90-480 with respect to plumbing fixture for the physically handicapped.
- B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- C. Protect installed fixtures from damage during remainder of construction period.
- D. Set shower receptor and mop basins in a leveling bed of cement grout.
- E. Install a stop valve in an accessible location in the water connection to each fixture.
- F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- G. Seal fixtures to walls and floors using silicone sealant as specified in other sections. Match sealant color to fixture color.
- H. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipts in a quantity of one device for each ten fixtures. Furnish faucet repair kits complete with all necessary washers, springs, pins, retainers, packings, O-rings, sleeves, and seats in a quantity of one kit for each forty faucets.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units

at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.4 ADJUSTING AND CLEANING

- A. Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation using manufacturer's recommended cleaning methods and materials. Provide protective covering for installed fixtures, water coolers, and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.
- C. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.
- D. Adjust or replace washers to prevent leaks at faucets and stops.

END OF SECTION 22 40 00

SECTION 230500 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and supplementary conditions and special Conditions sections, apply to the work of this section.
- B. Attention is directed to the Mechanical and Electrical plans, all of which affect the work herein.
- C. This section is a Division-23 Basic Mechanical Requirements section and is part of each Division-23 section.

1.2 SUMMARY

- A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division-23.

1.3 DESCRIPTION OF WORK

- A. The scope of the work shall include complete mechanical systems as shown on the plans and as specified herein. The General Conditions and Special Conditions of these specifications shall form a part and be included under this Section of the Specifications. Provide all supervision, labor, material, equipment, machinery, plant, and any and all other items necessary to complete the mechanical systems. All items of equipment are specified in the singular; however, provide and install the number of items of equipment as indicated on the drawings, and as required for complete systems.
- B. Systems shall include all appurtenances as required to achieve the operating conditions as shown and specified and shall result in a superior installation.
- C. Scope of work shall include, but not be limited to, the following:
 - D. All electrical work required to support mechanical equipment or is otherwise necessary to operate mechanical equipment, shall be the responsibility of the Mechanical Contractor (including, but not limited to) electrical motors for all motor-operated equipment required under this Division, motor controllers, starters, pilot lights and relays, line and low voltage control wiring, raceways, connections to switches, and other electrical devices furnished with temperature control systems except as otherwise provided for in other Divisions of this Specification.

1.4 INTENT OF SPECIFICATIONS AND DRAWINGS

- A. The drawings show the general run of pipes, ducts, etc., and the approximate location of apparatus. Do not scale the drawings to determine exact positions and clearances. Coordinate final location of materials with all other trades prior to installation.
- B. Bring to the attention of the Engineer immediately any changes in the size or location of the material or equipment which may be necessary in order to meet field conditions, or in order to avoid conflict with the work of other sections. Obtain the Engineer's approval before such deviations are made.

C. Methods of construction and details of workmanship where not specifically described herein or indicated on the drawings shall be the responsibility of the contractor. The contractor may submit alternate methods and details for review of the engineer. It is the intent of these specifications to provide complete systems, left in good working order, ready for operation, including necessary labor and materials, whether or not specifically shown on the drawings or mentioned herein.

D. Obtain from the Architect the location of any apparatus not definitely located on the drawings. Locate equipment and accessories in such a manner as to provide easy access for proper service and maintenance.

E. Before submitting proposals, this Contractor shall examine the specifications and all drawings relating to his work and become fully informed as to the extent and character of the work and the relation of his work to the work of other sections. Examine the drawings of other sections, the details of the building construction and note conditions, which affect his work. In the event that any referenced specification, drawing, detail, etc. is omitted or is in conflict, this Contractor shall obtain clarification from Architect/Engineer.

F. It is the intention of these specifications and drawings to call for finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."

G. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.5 CODES, RULES, PERMITS, FEES

A. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, etc., in order to comply with all applicable laws, ordinances, rules and regulations, whether or not specifically shown on drawings and/or specified. The Contractor shall use the latest revision to these codes accepted by the local Authority Having Jurisdiction.

- Life Safety Code NFPA 101
- Accessibility for the Handicapped ANSI A117
- National Electrical Code NFPA 70
- Florida Building Code - 2017
- Florida Building Code – Mechanical 2017
- Florida Building Code – Plumbing 2017

B. All material and equipment for the electrical portion of the mechanical systems shall bear the approval label, or shall be listed by, Underwriters' Laboratories, Inc. Refer to General Conditions and Supplemental General Conditions, regarding any required permits and fee payments.

1.6 ERRORS AND OMISSIONS

A. Any and all obvious errors and/or omissions in the plans, specifications, and contract documents shall be called to the attention of the Architect or Engineer at least fourteen days prior

to the bid date. If proper modification is not received, no additions to the contract amount will be authorized for this work.

B. In the event there is a conflict in the plans and more than one system is described, specified or otherwise indicated, the Owner reserves the right to select which system shall be installed. In the event a system is identified by description or performance only, the Contractor shall provide shop drawings with product submittals indicating the complete working arrangement of the proposed installation for review by the Owner. The Owner reserves the right to reject any and all components or operating sequences.

1.7 SUBMITTALS AND SHOP DRAWINGS

A. If directed by the Engineer, the Subcontractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

B. At the time of each submission, the Contractor shall call the Engineer's attention (in writing) to, and plainly mark on shop drawings, any deviations from the Contract Documents.

C. Samples, drawings, specifications, catalogs, submitted for review, shall be properly labeled indicating specific service for which material or equipment is to be used, location, section and article number of specifications governing, Contractor's name, and name of job. All equipment shall be labeled to match labeling on contract documents.

D. Control systems: Submit description of operation and schematic drawings of the entire control system. Include bulletins describing each item of control equipment or component.

E. Catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested, shall be specific and identification in catalog, pamphlet, etc. of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

F. Review of shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

G. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will be allowed.

H. Submit all Division-23 submittals at one (1) time in one (1) integral group. Piece-by-piece submission of individual items will not be acceptable. Engineer may check contents of each submittal set upon initial delivery; if not complete as set forth herein, submittal sets may be returned to Contractor without review and approval and will not be accepted until made complete.

I. Submit Manufacturer's published technical data, catalog cuts, wiring diagrams, shop drawings, samples and testing and balancing logs for all elements of the HVAC work. Submit under provisions of General Conditions and Supplementary General Conditions.

J. No equipment or components shall be fabricated, delivered, erected, or connected other than from drawings reviewed by the Engineer.

K. It shall be understood that review of shop drawings by the Engineer does not supersede the requirement to provide a complete and functioning system in compliance with the Contract Documents.

L. Equipment supports: Submit detailed drawings indicating equipment weight and dimensions, support material, connections, anchoring, and vibration isolation.

1.8 APPROVED MATERIALS

A. Materials and equipment shall be new (unless specified as existing), of makes and kinds specified herein, or as indicated on the drawings, without exception.

B. The drawings are based on the equipment and materials specifically designated. If substitute material and equipment is to be installed the contractor shall provide drawings showing any changes required by this equipment or material and be responsible for its installation in the allotted space with proper clearance for service and repairs. Substitute material shall be approved by the engineer prior to installation.

C. Where approved deviation requires different quantity or arrangement of foundations, supports, ductwork, piping, wiring, conduit, and any other equipment or accessories normal to this equipment, Contractor shall furnish said changes and additions and pay all costs for all changes to the work and the work of others affected by this substitution or deviation.

D. Deviations mean the use of any listed approved manufacturer other than those on which the drawings are based.

E. All requests for deviation shall clearly and specifically indicate any and all differences or omissions between the product specified as basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products.

- Principle of operation.
- Materials of construction or finishes.
- Thickness or gauge of materials.
- Weight of item.
- Deleted features or items.
- Added features or items.
- Changes in other Contractor's work caused by the substitution.
- Physical dimensions.

F. Where the Contractor proposes to use an item of equipment other than that specified or detailed on the drawing, which requires any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the mechanical or electrical, all such redesign, and all new drawings and detailing required therefore, shall be prepared by the Subcontractor at his own expense and submitted to the Engineer for approval.

G. Where such approved deviation requires quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

1.9 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instruction to Bidders and General & Special Conditions Section "Or Equal and Substitutions" for requirements in selecting products and requesting substitutions.

B. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name or catalog number shall be provided as specified.

C. Substitutions will not be permitted without approval fourteen (14) days prior to bid date from the Engineer.

D. Approvals of "or equivalent" substitutions will be issued through eProcure to all bidder as an addendum to the Contract Documents. Any Contractor wishing to submit for an "or equivalent" substitution will submit with his request complete catalog information to permit evaluation of the product.

1.10 CHASES, CUTTING AND PATCHING

A. Provide and place required sleeves, forms and inserts before walls, partitions, floors or roofs are built. The cost of cutting and patching of walls, partitions, ceilings and floors necessary for reception of this Subcontractor's work caused by his failure to provide or properly locate sleeves, forms and inserts, or caused by incorrect location of this work shall be borne by this Subcontractor.

B. When it becomes necessary to cut finished materials, submit to the Engineer for approval, drawings showing the work required and obtain approval before doing such cutting.

C. Chases and openings in the walls will be provided under the work of other sections. Furnish exact dimensions and locations of these openings to suit the apparatus to be used before such walls are built.

D. No cutting or altering the work of other sections will be permitted without the consent of the Engineer.

E. No structural members shall be cut without the previous written approval of the Structural Engineer and the Architect.

1.11 PENETRATIONS

A. All penetrations through a fire rated barrier will be protected by a method listed in the latest revision to the Life Safety Code Book 101.

1.12 PROTECTION

A. Protect all work and material provided under this Division from damage. All damaged equipment work or material provided under this Division shall be replaced with new. Rebuilds are not acceptable.

B. Protect all work and equipment until inspected, tested, and accepted. Protect work against theft, injury, or damage; and carefully store material and equipment received on site, which are not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of obstructing material.

1.13 SCAFFOLDING, RIGGING, HOISTING

A. Provide all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

1.14 REMOVAL OF RUBBISH

A. This Contractor shall at all times keep premises free from accumulations of waste materials or rubbish caused by his employees or work. At completion of work he shall remove all his tools, scaffolding, materials, and rubbish from the building and site. He shall leave the premises and his work in a clean, orderly, and acceptable condition.

B. All plaster, concrete, cement, etc. shall be removed from all pipe, hangers, and equipment prior to painting and/or concealment.

1.15 SAFETY

A. This Contractor shall comply with Section 107 of the Contract work hours and safety standards act (40 U.S.C.333), Title 29 - Labor, Chapter XIII, Bureau of Standards, Department of Labor, Part 1518 - Safety and Health Regulations for construction; and that his housekeeping and equipment be maintained in such a manner that they comply with the Florida industrial commission safety code and regulations of the Federal Williams - Steiger Occupational Safety and Health Act of 1970 (OSHA), wherein it states that the Contractor shall not require any laborer or mechanic employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety.

1.16 SUPERVISION

A. This Contractor shall provide a competent, experienced, full time superintendent who is acceptable to the Engineer and Owner, and who is authorized to make decisions on behalf of the Contractor.

1.17 LUBRICATION

A. Where necessary, provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a lubrication tube with suitable fitting to an accessible location and suitably identify it.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated until final acceptance by the Owner.

1.18 WIRING DIAGRAMS

A. Furnish for use under Division-26 all wiring diagrams as may be required for the installation of the wiring to insure proper operation and control of the equipment provided under this Division. Provide the diagrams in time to avoid delays.

1.19 MATERIAL AND WORKMANSHIP

A. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by the Engineer shall be furnished. Refer to substitutions in this section.

B. Unless otherwise specifically indicated on the plans or specifications, all equipment and materials shall be installed with the approval of the Engineer in accordance with the recommendations of the Manufacturer. This includes the performance of such tests as the Manufacturer recommends.

1.20 QUIET OPERATION AND VIBRATION

A. All work shall operate under all conditions of load without any sound or vibration, which is objectionable in the opinion of the Engineer and the Owner. In case of moving machinery, sound, or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer and the Owner shall be corrected in an approved manner at no additional expense to the Owner. Vibration control shall be by means of approved vibration isolation.

1.21 ACCESSIBILITY

A. This Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all other Contractors whose work is in the same space, and shall advise them of his requirements. Such spaces and clearances shall, however, be kept to the minimum size required.

B. This Contractor shall locate all equipment, which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to, valves, traps, clean-outs, motors, controllers, switchgear, and drain points. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility.

C. This Contractor shall provide the General Contractor the exact locations of access panels for each concealed valve, control, damper, or other device requiring service. Access panels shall be provided by this contractor and installed by the General Contractor. Locations of these panels shall be submitted in sufficient time to be installed in the normal course of the work.

1.22 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS

A. All equipment, unless shown otherwise, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature and any attachments that are, in the opinion of the Engineer, not strong enough shall be replaced as directed. All equipment attachments shall meet the wind load requirements of the Florida Building Code.

1.23 REGULATORY REQUIREMENTS

A. Conform to applicable Codes and Standards as follows:

B. Certain standard materials and installation requirements are described by reference to standard specifications. These standards are as follows:

- AMA - Acoustical Materials Association.
- AMCA - Air Moving and Conditioning Association.
- ANSI - American National Standards Institute.
- ARI - Air Conditioning and Refrigeration Institute.
- ASA - American Standards Association.
- ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
- ASME - American Society of Mechanical Engineers Code of Un-fired Pressure Vessels.
- ASTM - American Society for Testing Materials.
- NEMA - National Electrical Manufacturers Association.
- SBCCI - Southern Building Code Congress International.
- SMACNA - Sheet Metal and Air Conditioning Contractor's National Association.
- UL - Underwriters Laboratories.

C. For additional standards and requirements see other sections of the specifications.

1.24 REMOVALS, RELOCATIONS, RECONNECTIONS, AND RESTORATIONS

A. Demolition of existing piping, equipment, etc., shall be done as indicated on the Drawings. Existing piping and/or equipment to be removed shall be offered to the Owner. If the Owner wishes to utilize the existing equipment elsewhere, this Contractor shall move the equipment to a building on site designated by the Owner for storage. If the Owner does not wish to utilize the existing equipment, then it shall be removed from the Owner's property. All material to be removed shall be discarded by the Contractor and they shall not be used again.

B. All demolition work shall be completely coordinated with the Owner forty-eight (48) hours prior to starting work. Demolition and reconnections requiring shutdown of existing systems shall be scheduled with the Owner/Engineer. If shutdown can only be accommodated on the weekend, or after normal working hours, such work shall be done at no additional cost to the Owner.

C. Location, capacity, size, etc. of existing equipment, piping, etc., was obtained from a combination of Owner furnished drawings and field survey. Verify all conditions at site prior to ordering material or commencing with work. Notify Engineer of any discrepancies prior to starting work or ordering material.

D. Survey existing facilities and utilities as necessary to determine location of shutoff or disconnect devices, drains, vents, etc. Temporarily store all items to be relocated, if required. Contractor shall be responsible for safe storage of all such items and shall replace any items lost or damaged during storage removal or reinstallation.

E. This Contractor shall replace any equipment, piping, valves, insulation, etc. damaged by him or his representatives. Replacement shall be new and be identical to the damaged item.

1.25 PROJECT/SITE CONDITION

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to work specified in other sections. Obtain permission of Owner/Engineer before proceeding.

1.26 WARRANTY

A. All work shall be warranted to be free from defects for a period of one year from date of substantial completion. This Contractor shall be responsible for all equipment warranties for a period of one year from date of substantial completion. See other sections for additional compressor warranties.

B. Compile and assemble the warranties specified in Division-23 into a separated vinyl covered, three ring binder, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include data of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.27 RECORD DRAWINGS

A. During the course of construction and the Subcontractor shall keep an accurate record of all deviations and changes of the work as indicated on the drawings and its actual installation.

B. This Contractor shall provide as-built record drawings (reproducible) before final payment will be issued. As-built drawings shall be the same scale as the original design drawings and of good drafting or ACAD quality.

END OF SECTION 230500

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SECTION 230512 - MECHANICAL RELATED WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. This section is a Division-23 Basic Mechanical Materials and Methods section, and is a part of each Division-23 section making reference to mechanical related work specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of mechanical related work required by this section is indicated on drawings and/or specified in other Division-23 sections.

B. Types of mechanical related work specified in this section include the following:

1. Access to Mechanical Work:

a. Access doors in walls, ceilings, and floors.

b. Removable cover plates in walls, ceilings, and floors.

2. Excavating for Mechanical Work:

a. Underground mechanical utilities and services.

3. Access requirements within mechanical work, to mechanical or electrical components within work, are specified in other Division-23 sections; not work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products for mechanical related work of sizes, types, ratings, and materials required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with mechanical related work similar to that required for this project.

C. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are small than minimum size requiring ratings as recognized by governing authority.

D. Codes and Standards: Comply with the Florida "Trench Safety Act".

1.4 SUBMITTALS

A. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

B. Excavation: Furnish written assurance the "Trench Safety Act" will be followed. Identify the method or methods of compliance. Identify by separate amount the cost of compliance, based on the linear feet of trench to be excavated or, in the case of shoring, the square feet of shoring to be used.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling.
- B. Protect property from damage which might result from excavating and backfilling.
- C. Protect persons from injury at excavations, by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

PART 2 - PRODUCTS

2.1 ACCESS TO MECHANICAL WORK

A. Access Doors:

- 1. General: Where floors, walls and ceilings must be penetrated for access to mechanical work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- 2. Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gage frames and 14-gage flush panel doors; 1750 swing with concealed spring hinges; flush screw- driver-operated cam locks; factory-applied rust-inhibitive prime- coat paint finish.
- 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering access doors which may be incorporated in the work include, but are not limited to, the following:
 - a. Manufacturers: Subject to compliance with requirements, provide access doors of one of the following:
 - Karp Associates, Inc.
 - Meadowcraft, Inc.
 - Milcor Div.; Inryco Inc.
 - Smith (Jay R.) Mfg. Co.
 - Zurn Industries, Inc.; Hydromechanics Div.

B. Removable Access Plates:

- 1. General: Where valves, control devices, cleanouts and similar elements of mechanical work are located within or behind wall, ceiling or floor construction or finishes, or below grade, and are not (cannot be) provided with integral removable access plates as specified in other Division-23 sections, provide removable access plates of types and sizes needed for access requirements, as indicated. Provide manufacturer's complete units with anchorages, fasteners and standard factory-applied finishes.
- 2. Wall/Ceiling Unit Construction: Except as otherwise indicated, and where adaptable to substrate, provide manufacturer's standard frameless round formed stainless steel or

chrome-plated brass low profile plate cover, with single exposed flush screw anchor, with bright polished finish.

3. Painted Finish: Where substrate is indicated for painted finish, provide steel units with prime-coat paint finish.

4. Floor Unit Construction: Except as otherwise indicated, provide manufacturer's standard round cast-iron units, with frame or body designed for casting flush in concrete; with removable plate secured with bronze screws, and surfaced with non-slip cast pattern; natural mill finish.

5. Sleeve-Type: Where required floor opening or hand hole extends through thickness of cast floor slab, provide unit body of same depth as slab thickness, to act as form for casting opening

6. Square Units: Where square units are indicated, provide manufacturer's modular units of size which integrate as closely as possible with finish flooring unit sizes (if any).

7. Recessed Units: Where finish of floor is other than concrete, provide recessed-panel type construction, of type and recess depth recommended to receive insets of floor finish indicated.

8. Finish: Provide recessed units with exposed metal (exposed after inset has been installed) of nickel bronze, manufacturer's standard finish. Provide matching fasteners.

9. Units Set at Grade: Except as otherwise indicated, provide manufacturer's standard round or square cast-iron units, complete cast-iron pipe extension to protect mechanical element being accessed; designed to be set slightly above finish grade, and to be either supported by compacted soil or to be encased in concrete; secure plate to body with bronze screws; natural mill finish on plate and body.

10. Available Manufacturers: Subject to compliance with requirements, manufacturers offering removable access plates which may be incorporated in the work include, but are not limited to, the following:

a. Manufacturer: Subject to compliance with requirements, provide removable access plates of one of the following:

- Josam Mfg. Co.
- Smith (Jay R.) Mfg. Co.
- Wade Div., Tyler Pipe.
- Zurn Industries Inc., Hydromechanics Div.

2.2 EXCAVATING FOR MECHANICAL WORK:

A. Backfill Materials:

B. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups, GW, GP, GM, SM, SW, and SP.

2. Unsatisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GC, SC, ML, CL, CH, OL, OH, and PT.

3. Subbase Material: Graded mixture of gravel, sand, crushed stone and crushed slag.

4. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing 3/8" sieve.

5. Backfill Material: Soil material suitable for compacting to required densities, and complying with AASHTO Designation M145, Group A-1, A-2-4, A-2-5 or A-3.
6. Drainage Fill Material: Washed and uniformly graded gravel, crushed stone or crushed slag, with 100% passing 1-1/2" sieve and not more than 5% passing No. 4 sieve.

PART 3 - EXECUTION:

3.1 ACCESS TO MECHANICAL WORK

- A. Comply with manufacturer's instructions for installation of access doors, floor doors, and removal access plates.
- B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- C. Adjust hardware and panels after installation for proper operation.
- D. Remove or replace panels or frames which are warped, bowed, or otherwise damaged.

3.2 EXCAVATING FOR MECHANICAL WORK

- A. General: Do not excavate for mechanical work until work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.
- B. Excavate with vertical sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.
- C. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.
- D. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at bottom of the excavations:
 1. Piping of 5" and less pipe/tube size.
 2. Cast-in-place concrete.
- E. Depth for Subbase Support: For large piping (6" pipe size and larger), tanks, and where indicated for other mechanical work, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.
- F. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.

- G. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- H. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- I. Excavation for Trenches: Dig trenches to uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of piping.
- J. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- K. Where rock is encountered, carry excavation 6" below required elevation and backfill with 6" layer of crushed stone or gravel prior to installation of pipe.
- L. For piping 5" or less in nominal size, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support piping on undisturbed soil.
- M. For piping 6" and larger in nominal size, tanks, and other mechanical work indicated to receive subbase, excavate to subbase depth indicated, or if not otherwise indicated, to 6" below bottom of work to be supported.
- N. Grade bottoms of trenches as indicated, notching under piping couplings to provide solid bearing for entire body of piping.
- O. Depth for Unsatisfactory Soil Conditions: Where directed (because of unsatisfactory soil condition at bottom of indicated excavation), excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth. Refer to Division-01 for change order procedure on additional work, including additional excavating and backfilling.
- P. Depth for Exterior Piping: Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam condensate, drainage) so that top of piping will not be less than 3'-6" vertical distance below finished grade.
- Q. Excavate near large trees (within drip line) by hand, and protect root system from damage or dryout to greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with asphaltic tree paint.
- R. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
- S. Retain excavated material which complies with requirements for backfill material.

T. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material.

U. Remove unused material from project site, and dispose of in lawful manner.

3.3 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

C. Maintain dry excavations for mechanical work, for removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through mechanical work excavations.

D. Install and operate well-point dewatering system to maintain ground water at level approximately 2'-0" below mechanical work excavations, until backfilling is completed.

3.4 BASE PREPARATION

A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form firm base for work. For piping, horizontal cylindrical tanks, and similar work, shape subbase to fit shape of bottom 90° of cylinder, for uniform continuous support.

B. Provide finely-graded subbase material for wrapped, coated, and plastic pipe and tanks.

C. Shape subbases and bottoms of excavations with recesses to receive pipe bells, flanged connections, valves and similar enlargements in piping systems.

D. Install drainage fill where indicated, and tamp to uniform firm density.

E. Concrete Encasement: Where piping under roadways is less than 2'-6" below surface of roadway, provide 4" base slab of concrete to support piping. After piping is installed and tested, provide 4" thick encasement (sides and top) of concrete before backfilling. Provide Class 2500 concrete for encasement and slab.

F. Previous Excavations: Where piping crosses over area more than 5'-0" wide which has been previously excavated to greater depth than required for piping installation, provide suitable subsidence-proof support for piping. Comply with details shown or, where not otherwise shown, provide one of the following support systems.

G. Excavate to undisturbed soil, in width equal to pipe diameter plus 2'-0". Install 8" courses of subbase material, each compacted to 95% of maximum density, as required to fill excavation and support piping.

H. Excavate to undisturbed soil, in width equal to pipe diameter plus 1'-0". Install lean concrete fill to required elevation for support of piping.

3.5 BACKFILLING

A. Do not backfill until installed mechanical work has been tested and accepted, wherever testing is indicated.

B. Install drainage fill where indicated, and tamp to uniform firm density. Backfill with finely-graded subbase material to 6" above wrapped, coated, or plastic piping and tanks.

C. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

D. Backfill simultaneously on opposite sides of mechanical work, and compact simultaneously; do not dislocate work from installed positions.

E. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driver hand-operated compaction equipment.

F. Lawn and Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.

G. Paved Areas, Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.

H. Roadways: 90% for cohesive soils; 95% for cohesionless soils.

I. Backfill to elevations matching adjacent grades, at time of backfilling excavations for mechanical work.

J. Compaction Tests: Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by Architect/Engineer. Allowable density tolerance is not more than one-test-out-of-5 falling more than 2 percentage points below specified density.

3.6 PERFORMANCE AND MAINTENANCE, EXCAVATION WORK

A. Subsidence: Where subsidence is measurable or observable at mechanical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

END OF SECTION 230512

MECHANICAL RELATED WORK

23 05 12 - 7

Milhaus SR-82
Fort Myers, Florida
Baker Barrios Architects
Project No. 220035.00

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SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

- B. Division-23 Basic Mechanical Materials and Methods section apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of testing, adjusting and balancing work required by this section is indicated on drawings and schedules and by requirements of this section; and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems, and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

- B. Component types of testing, adjusting and balancing specified in this section includes the following as applied to mechanical equipment. The listing below is to be expanded or reduced as applicable to special project requirements. Refer to drawings and schedules.
 - 1. Fans
 - 2. Air handling units
 - 3. Ductwork systems

- C. Refer to Division-23 sections for installation and start-up of equipment to be tested, adjusted, and balanced; not work of this section.

- D. Refer to Division-26 sections for electrical hook-up and wiring of equipment to be tested, adjusted and balanced; not work of this section.

PART 2 - RESPONSIBILITY OF THE HVAC SUB-CONTRACTOR:

2.1 GENERAL

- A. This sub-contractor shall cooperate with the test and balance agency in establishing a schedule to perform this work. Any changes in schedule shall be coordinated with the test and balance agency.

- B. Test and balance work shall not begin until all systems have been completed and are in full working order to the satisfaction of the Project Architect/Engineer and the owner. This sub-contractor shall make all preliminary tests and adjustments before advising in writing that test and balance is ready to begin and shall place all systems and equipment into full operation during each working day of testing and balancing.

- C. All systems shall be tested and balanced under full load conditions.

- D. Replacement of adjustable pulleys, additional balancing dampers, pressure taps, balancing valves, cocks and fittings, etc., required to effect proper air and water balance shall be furnished

and installed by this sub-contractor at no additional cost to the Owner. Test and balance agency shall furnish the sub-contractor and Project Architect/Engineer with a list of items that must be repaired or adjusted. The contractor shall do this work as soon as possible so as not to delay the completion of the test and balance work.

E. All air filters shall be replaced, all bearings lubricated, belts tensioned, drives aligned, coil fins cleaned and all strainers cleaned by this sub-contractor before proceeding with test and balance and, thereafter, as required by the test and balance agency.

F. All systems shall be placed into service using approved start up procedures. The HVAC sub-contractor shall be responsible for proper initial setting and adjustment of all HVAC equipment, air handlers, exhaust fans, etc. furnished and installed by him and shall verify same for the test and balance agency. The HVAC sub-contractor shall perform preliminary testing and balance on all equipment.

G. The HVAC sub-contractor shall provide test openings as required, operate HVAC equipment and provide trades persons to assist and make adjustments for test and balance.

H. When the test and balance agency is ready to test according to the established schedule, but is prevented from testing, balancing, making adjustments or taking measurements due to incompleteness of the work, all extra charges for test and balance attributable to the delay may be back charged to this sub-contractor. The Owner, or his representative, shall be the judge as to whether a delay has occurred.

I. The HVAC sub-contractor shall furnish the test and balance agency a complete set of as-built plans and specifications, shop drawings, schedules and change orders as may be required.

J. The HVAC subcontractor shall provide to the Owner a certified statement that the HVAC systems have been balanced to optimum performance capabilities in accordance with plans and specifications.

PART 3 - EXECUTION FOR HVAC SUB-CONTRACTOR:

3.1 Air Balance:

A. This sub-contractor shall prepare the air systems for balancing and verify same for test and balance agency as follows:

1. Mechanically check fans, blowers and air handling equipment and make available to operate under design conditions.
2. Set volume dampers, air dampers, and vanes in their normal position.
3. Set grilles, diffusers, etc., installed with vanes, blades in their normal position.
4. Mechanically check controls, whether they are electronic, electric, or a combination thereof, and make available to operate under design conditions. Mark damper shafts and locking devices to accurately represent the position of their respective dampers.

B. Temperature Control Systems:

1. The temperature controls installer shall cooperate fully with the test and balance to ensure maximum effective systems operation. The controls installer shall initially set, adjust, relocate (if necessary), and calibrate all controls. The test and balance shall verify proper operation of controls and adjust controls to proper settings.

C. The HVAC subcontractor shall perform the following:

1. Check for proper location of sensors and thermostats and verify proper design settings.
2. Verify proper operation of switches, damper motors, and interlocks.
3. Verify that proper sequence of operation occurs in all control modes and is in accordance with shop drawings and control diagrams (or point list).

PART 4 - RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

4.1 Temperature control contractor

A. The temperature control contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The temperature controls installer shall cooperate fully with the test and balance to ensure maximum effective systems operation. The controls installer shall initially set, adjust, relocate (if necessary), and calibrate all controls. The test and balance shall verify proper operation of controls and adjust controls to proper settings. The HVAC sub-contractor shall coordinate the controls contractor's work to provide information, drawings and any assistance required by the test and balance agency as may be necessary to complete their work.

B. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats. Provide system printout to all points to ensure operation and communication with all terminal points.

C. Verify that all controlling instruments are calibrated and set for design operating conditions.

D. Calibrate room thermostats after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings in the controlled space compared to the computer readings.

E. The temperature-control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to pump controllers, chillers, actuators, air handling units, or any other device that may need set points changed so that the testing and balancing work can be performed. All required hardware and software related to the installed control system must be provided by the temperature-control contractor to the test and balance firm and the owner to allow testing of the systems and continued operation.

PART 5 - REQUIREMENTS AND RESPONSIBILITY OF THE TEST AND BALANCE AGENCY:

5.1 Agency Qualifications:

- A. Operating not less than three (3) years as an independent testing agency. During this period, the agency must have continuously performed testing and balancing work as an agency - not as an individual.
- B. Agency must have a current certification from a nationally recognized testing and balancing organization.
- C. Agency must have an established place of business separate and distinct from a home or residence.
- D. Agency shall have no affiliation with engineers, architects, installing contractors, or manufacturers of components of environmental systems and is otherwise independent of the project.
- E. Provide documented evidence of successful completion of fifteen (15) total system balancing projects as a balancing agency.
- F. Provide a list of instruments owned by the agency, with manufacturers name, model number, date of most recent calibration, and serial number where applicable.
- G. Provide a written resume of the principals of the agency describing and verifying experience in the HVAC field.
- H. Prove in writing that properly trained personnel and supervisors are being employed by the agency. Give a brief resume of the experience and education of each technician engaged in total systems balance.
- I. Provide proof of financial stability of the agency.
- J. Resume of professional engineer registered in the State of Florida who will sign and "seal" certified reports.
- K. The professional engineer shall be a permanent, full time owner, staff member or employee of the test and balance agency and have full project responsibility.

5.2 Codes and Standards

- A. AABC Compliance: Comply with AABC's Manual MN-1, "AABC National Standards," as applicable to the mechanical air and hydronic distribution systems, and associated equipment and apparatus.
- B. NEBB Compliance: Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to mechanical air and hydronic distribution systems, and associated equipment and apparatus.
- C. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments and testing, adjusting, and balancing, except as otherwise indicated.

5.3 Submittals

A. Submit certified test reports, signed by test and balance supervisor who performed test and balance work. In addition, have report certified by professional engineer who is familiar with test and balance work and also with project, and who is registered in jurisdiction where testing is being conducted.

B. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.

C. The test and balance agency will submit six (6) copies of the test and balance report as follows:

Architect
Engineer
General Contractor
Mechanical Contractor
Owner (2)

D. All data and information shall be compiled in a neat, orderly format on 8-1/2" x 11" test forms.

E. The Owner may choose to provide verification of test and balance reports and such verification shall be by another independent agency. Reports found to be inaccurate will be disallowed and the test and balance agency will be required to repeat operations under the supervision of the independent agency until accurate reports are completed. The cost of initial checking will be born by the Owner unless the report is found to be inaccurate, in such case, the costs of the verification test and balance and all subsequent costs of supervision in order to secure acceptable reports will be borne by the test and balance agency.

5.4 Job Conditions

A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.

B. Do not proceed until work scheduled for testing, adjusting and balancing is clean and free from debris, dirt and discarded building materials.

5.5 Patching Materials

A. Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

B. At tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.

C. Refer to Division-23, "Mechanical Related Work" section for patching of holes in insulation, ductwork and housings which have been cut or drilled for test purposes. In each case, patching is the responsibility of the test and balance agency but is to be completed by original installer.

5.6 Test Instruments

A. Utilize test instruments and equipment for test and balance work required of type, precision and capacity as recommended in the following test and balance standards:

B. NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems".

C. AABC's Manual MN-1, "AABC National Standards".

5.7 Guarantee

A. The test and balance agency shall include extended services for one (1) year after completion of test and balance work, during which time the Project Architect/Engineer and/or Owner at his discretion, may request a recheck or resetting of any piece of equipment listed in test report.

B. The test and balance agency shall provide technicians to assist in making any tests required. If at any time during the first year of operation system is not working properly, it shall be rebalanced.

C. The test and balance agency shall provide to the Owner a certified statement that the HVAC systems have been balanced to optimum performance capabilities in accordance with plans and specifications.

PART 6 - EXECUTION FOR TEST AND BALANCE CONTRACTOR:

6.1 GENERAL

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with test and balance work until unsatisfactory conditions have been corrected in manner acceptable to tester.

B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

C. The test and balance Contractor shall perform the following tests and balance system in accordance with the following requirements:

6.2 Air Balance

A. Test and adjust fan RPM to design requirements.

B. Test and record motor voltage and full load amperes.

C. Test and adjust system for design CFM recirculated air.

D. Test and adjust system for design CFM outside air.

- E. Test and adjust system for design CFM exhaust air (as applicable).
- F. Test and adjust each diffuser, grille, and register to within +/- 10% of design requirements.
- G. Measure static pressure at fan outlet.
- H. Verify function and calibration of temperature controls to +/- 1.5 degree of set point.
- I. The following shall be completed as part of the air side test and balance, following the completion of both the air and water side test and balance:
 - 1. Test and record entering air temperatures (D.B. heating and cooling).
 - 2. Test and record entering air temperatures (W.B. cooling).
 - 3. Test and record leaving air temperatures. (D.B. heating and cooling).
 - 4. Test and record leaving air temperatures. (W.B. cooling).
 - 5. Test and record all room temperatures, DB and WB. Test shall be made near room sensor installed at 4 feet above floor.
- J. Readings and tests of diffusers, grilles and registers shall include test resultant velocity where appropriate, and required CFM and test resultant CFM after adjustments.
- K. In cooperation with the control manufacturer's representative, the test and balance agency shall set adjustments of automatically operated dampers to operate as specified, indicated, and/or noted.
- L. All diffusers, grilles, and registers shall be adjusted by the test and balance agency to minimize drafts in all areas.
- M. The test and balance agency shall visually verify that low pressure duct systems are constructed and sealed in accordance with SMACNA construction standards.

PART 7 - EQUIPMENT

7.1 Equipment

A. Compile all information required as shown, but not limited to, in a neat, orderly, itemized format on 8-1/2" x 11" test forms. Submit the following data to Owner:

- 1. Air Handling Units (including fan coils, unit ventilators and heat pumps):
 - a. Mark number
 - b. Unit manufacturer and model number
 - c. Total supply air cfm specified and actual
 - d. Return air cfm specified and actual
 - e. Outside air cfm specified and actual
 - f. Unit static pressure (discharge static - suction static).
 - g. Specified external static pressure
 - h. Cooling - return and supply air DBF and WBF specified and actual
 - i. Outside air DBF and WBF at time of test

- j. Voltage, phase and cycles specified and actual
- k. BTU per hour at test conditions
- l. BTU per hour when converted to specified load conditions

2. Fans

- a. Mark number
- b. Manufacturer and model number
- c. Total cfm supply specified and actual
- d. Static pressure (discharge static - suction static)
- e. Specified external static pressure. Full load amperage specified and actual
- f. Motor HP specified and actual (name plate)
- g. Motor and fan RPM specified and actual
- h. Sound level (DB) specified and actual, if necessary
- i. Voltage, phase and cycles specified and actual

3. Air Devices (grilles, registers and diffusers):

- a. Mark number
- b. Room number
- c. CFM specified and actual
- d. Size
- e. Effective area
- f. Velocity FPM specified and actual

PART 8 - COMPLETION

- A. Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.
- B. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original installer.
- C. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of test and balance work. Provide markings with point or other suitable permanent identification materials.
- D. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where necessary, modifications which exceed requirements of contract documents for mechanical work.
- E. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

END OF SECTION 230593

SECTION 233113 - METAL DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section. The metal ductwork shall be fabricated and installed in accordance with SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

B. Refer to other Division-23 sections for exterior insulation of metal ductwork; not work of this section.

C. Refer to other Division-23 sections for ductwork accessories; not work of this section.

D. Refer to other Division-23 sections for fans and air handling units; not work of this section.

E. Refer to other Division-23 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

- SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
- ASHRAE Standards: Comply with 2008 ASHRAE Handbook, HVAC Systems and Equipment, Volume Chapter 16 "Duct Construction," for fabrication and installation of metal ductwork.
- NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
- Energy Efficiency Code Compliance: Comply with applicable sections of the latest approved edition of the "Florida Energy Efficiency Code for Building Construction", in regard to construction, sealing, and insulation of metal ductwork.

- Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.4 SUBMITTALS

A. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division-01.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide dual wall materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A 167; Type 302, 304, or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.

C. Duct Liner: Where shown on the drawings, shall be fibrous glass, complying with Thermal Insulation Manufacturers Association (TIMA) AHC-101; of 1" thickness or as indicated, density not less than 1.5 pcf, and thermal resistance R, not less than 4.2. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and limited combustibility and the airstream surface coating should contain an immobilized, EPA registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, with an NRC not less than .70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .25 Btu-in/hr-ft-°F at 75° F mean temperature.

D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".

E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

F. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in duct-work.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

I. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4" diameter or 3/16" thickness may be plain (not galvanized).

J. For exposed stainless steel ductwork, provide matching stainless steel support materials.

K. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

L. Flexible Ducts: Provide flexible ducts of spiral-wound spring steel with polyester core, 1 1/2" thick .75 pcf density fiber-glass insulation blanket, and aluminized reinforced vapor barrier; complying with UL 181 for Class 1 duct.

2.3 FABRICATION

A. Shop fabricate ductwork in 4, 5, 8 or 10-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field

assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards".

C. Shop fabricate ductwork of gages and reinforcement complying with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction".

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "DUCTWORK ACCESSORIES" for accessory requirements.

E. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

2.4 FACTORY-FABRICATED LOW PRESSURE DUCTWORK

A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.

C. Gage: 28-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.

D. Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

E. Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, and are limited to, the following:

- Semco Mfg., Inc.
- United Sheet Metal Div., United McGill Corp.
- Lindab Industries.

2.5 FACTORY FABRICATED DUAL WALL INSULATED DUCTWORK

A. General: Provide factory fabricated dual wall insulated duct and fittings where duct is exposed to view.

B. Material: Duct shall be constructed of a perforated inner liner, a one inch layer of fiberglass insulation, and an outer pressure shell. Duct shall be of spiral lockseam construction, fabricated from galvanized steel in accordance with ASTM-A527 standards.

C. Gauge: The duct and fittings shall be fabricated of the following gauge material:

1. DUCT

Inner Liner Diameter	Outer Shell Gauge	Inner Liner Gauge	Inner Liner Construction
3-8 inches	28	28	Standard Spiral
9-12 inches	28	28	Ribbed Spiral
13-24 inches	26	28	Ribbed Spiral
25-34 inches	24	28	Ribbed Spiral
35-42 inches	22	28	Ribbed Spiral
44-48 inches	22	26	Ribbed Spiral
50-58 inches	20	26	Ribbed Spiral
60-82 inches	18	22*	Standard Spiral

2. FITTINGS

Inner Liner Diameter	Outer Shell Gauge	Inner Liner Gauge
3-12 inches	26*	24
13-24 inches	24	24
25-34 inches	22	24
35-48 inches	20	22
50-58 inches	18	22
60-82 inches	16	20

* Mitered 90° elbows will be 24 gauge through 24" liner diameter.

D. Connections: All double-wall duct and fittings will be provided with both an inner liner coupling and an outer pressure shell coupling. Outer shell connections can be by slip joint or flanged joint; however, flanged joints are recommended in sizes greater than 36 inches in diameter. In either case, a slip coupling will be used to join inner liner sections at duct/duct joints. Fitting liners will be extended two inches beyond the outer shell cut-off to provide an inner liner coupling at duct/fitting joints.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, but are not limited to, the following:

- Semco Mfg., Inc.
- United Steel Metal Div., United McGill Corp.
- Lindab Industries.

PART 3 - EXECUTION
3.1 INSPECTION

A.General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF METAL DUCTWORK:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight and noise-less (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

B. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal spaces between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.

G. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between ducts and substrate, in accordance with requirements of Division-07 Section "FIRESTOPPING".

H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

I. Installation: Install metal ductwork in accordance in SMACNA HVAC Duct Construction Standards.

3.3 INSTALLATION OF DUCT LINER:

A. All portions of the duct shall be completely covered. The smooth surface of the duct liner shall face the airstream. The duct liner shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the side pieces.

B. Duct liners shall be installed following the guidelines in the NAIMA "Duct Liner Installation Standard."

C. Adhere the duct liner to the sheet metal with full coverage of adhesive that conforms to ASTM C 916. All exposed leading edges and transverse joints shall be coated with a field or factory applied edge coating and shall be neatly butted without gaps. Factory or field cuts shall be liberally coated with adhesive.

D. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any pint where lined duct is preceded by unlined duct.

E. Secure duct liner with mechanical fasteners spaced per the manufacturers requirements. The pin length should be such as to hold the material firmly in place with minimum compression of the liner material.

F. Duct liner used for noise control shall be 2 inch thick.

3.4 INSTALLATION OF FLEXIBLE DUCTS:

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 7' - 0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".

3.5 INSTALLATION OF KITCHEN EXHAUST DUCTS:

A. General: Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000°F (1093°C) temperature range. Install without dips or traps which may collect residues, except where traps have continuous or automatic residue removal. Provide access openings at each change in direction, located on sides of duct 1-1/2" minimum from bottom, and fitted with grease-tight covers of same material as duct.

3.6 FIELD QUALITY CONTROL

A. Leakage Tests: After each duct system which is constructed for duct classes over 3" is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than 1% of system design air flow.

3.7 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated or required.

3.8 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: Refer to Division-23 section "TESTING, ADJUSTING, AND BALANCING" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 23 31 13

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including general and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

1. Ceiling air diffusers.
2. Registers and grilles.
3. Louvers.

C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards

- ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
- ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
- ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
- ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
- AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
- AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
- NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

B. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

C. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

D. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and/or that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule.:

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, and are limited to, the following:

- Air Guide Corp.
- Carnes Co.; Div. of Wehr Corp.
- Krueger Mfg. Co.
- MetalAire
- Price Industries
- Titus Products Div.; Philips Industries, Inc.

2.2 REGISTER AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Surface Compatibility: Provide registers and grilles with border styles that are compatible with adjacent systems, and that are specifically manufactured to fit into construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.

D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, and are not limited to, the following:

- Air Guide Corp.
- Carnes Co.; Div. of Wehr Corp.
- Krueger Mfg. Co.
- MetalAire
- Price Industries
- Titus Products Div.; Philips Industries, Inc.

2.3 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specification for types of substrate which will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, and are limited to, the following:

- Arrow United Industries
- Creative Metals
- Greenheck
- Louvers & Dampers, Inc.
- Ruskin Mfg. Co.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.3 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION 233700

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and General, Supplemental, and Special Conditions Specification sections, apply to work of this section.
- B. Attention is directed to the Structural and Mechanical plans, all of which affect and shall be considered as part of the work herein. The work of the Electrical Contractor must be coordinated with the work of all other trades.

1.2 SUMMARY:

- A. This Section specifies the basic requirements for electrical installations.

1.3 ERRORS AND OMISSIONS:

- A. Any and all obvious errors and/or omissions in the plans, specifications, and contract documents shall be called to the attention of the Engineer at least fourteen days prior to the bid date. If proper notification is not received, no additions to the contract amount will be authorized for this work.
- B. In the event there is found to be a conflict within the contract documents, the Owner shall be the final determinant of the conflict resolution.

1.4 DESCRIPTION OF WORK:

- A. Scope: The scope of the work covered herein consists of furnishing all labor, materials, necessary equipment and services to complete the Electrical work and related work in full accordance as indicated on the drawings, as specified herein or both and subject to the terms and conditions of the Contract. The work will include, but is not necessarily limited to the following:
 - 1. Panelboards
 - 2. Disconnect Switches
 - 3. Conduit and Tubing
 - 4. Conductors
 - 5. Grounding
 - 6. Wiring Devices
 - 7. Overcurrent Protection
 - 8. Lighting Fixtures and Lamps
 - 9. Connection of Motors, Control Devices and Electrical Equipment Furnished by Others
 - 10. Testing
 - 11. Record Drawings
- B. All other items noted herein, shown by the electrical plans, or reasonably to be interpreted from the plans necessary to complete the electrical system shall be provided and installed under the work of this Section, whether same are specifically mentioned herein or not.

- C. Intent: It is the intent of these documents to describe and show a complete electrical system. However, the work shall be complete even though minor items may not be specifically called for or shown. The installation must meet all governing codes and shall be subject to the approval of the Engineer and all agencies having jurisdiction.
- D. Work Not Covered In This Section: Recesses, chases, and other provisions to be made in the structure required to accommodate electrical work, conduit, panels, switches, etc., shall be provided by the trades concerned. The Electrician shall, however, notify all such trades of his exact requirements ahead of time. He shall pay the costs of any cutting or patching caused by his failure to do so. All such remedial work shall be done only by mechanics of the trades involved.
- E. Coordination Drawings: The contractors are responsible to properly coordinate their work with other trades and the structural drawings. The contractor(s) shall be responsible to overlay all trades and structural drawings to produce a composite set of coordination drawings to ensure all necessary clearances are maintained. Similar coordination drawings in elevation shall be produced at critical building sections and other areas where close coordination is a concern. Coordination drawings shall be submitted to the Engineer for review prior to commencement with the installation of the work.
- F. Measurements: Should the Subcontractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer through the General Contractor, and shall not proceed with his work until he has received instructions from the Engineer.
- G. Drawings: Drawings are diagrammatic and indicate the general arrangement of systems and work included in the contract. Drawings are not to be scaled. The Structural drawings and details shall be examined for exact location of fixtures and equipment. Where they are not definitely located, this information shall be obtained from the Engineer.
- H. The contractor shall follow drawings in laying out work and check drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Engineer shall be notified before proceeding with installation.
- I. If directed by the Engineer, the Subcontractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.
- J. Summary: Electrical work can be generally summarized, but not limited to, the following:
- K. General Work: General work associated with electrical systems and equipment, and to be performed as electrical work, includes excavating, conduit sleeves and supports, anchors, vibration and sound isolation, access panels, identification, record drawings, installation permits, tests, inspections by governing authorities, electrical work of certain temporary facilities and services, cutting-and- patching work, utility company connection coordination, start-up of electrical systems and equipment, training of Owner's operating personnel, operating and maintenance manuals, final cleaning of electrical and similar work.
- L. Wiring and Power Distribution: Provide enclosures, meters, electrical boxes, conduit systems, raceways, wires/cables, wiring devices, overload protective devices, equipment connections, grounding systems, and similar work, all as indicated on electrical drawings and elsewhere in contract documents.

- M. Lighting: General light fixtures for both interior and exterior lighting, and including emergency lighting and exit signs, self-contained emergency fixtures, special-purpose fixtures and the installation of owner provided fixtures.
 - N. Special Electrical Systems: Included but not necessarily limited to:
 - 1. Surge Protective Devices, Section 264313
 - O. Items of equipment, which are furnished by Others (including Owner) and are to be installed as electrical work, include the following:
 - P. HVAC Equipment: Provide all necessary conduit systems, disconnects, etc. and make all power and low voltage connections for air handlers, condensing units, (duct) heaters, exhaust fans, pumps, control equipment, etc. Coordinate and provide any required control system connections with HVAC Contractor.
 - Q. Misc. Equipment: Provide all necessary disconnects and make all power connections as required for water heaters, pumps, controllers, systems, etc.
- 1.5 CODES, RULES, PERMITS, FEES:
- A. The Subcontractor shall give all necessary notices, obtain all permits and pay all government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.
 - B. The Subcontractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, or drawings necessary to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.
 - C. All materials furnished and all work installed shall comply with the following:
 - 1. Life Safety Code NFPA 101-2015
 - 2. Applicable NFPA Fire Codes
 - 3. Accessibility for the Handicapped ANSI A117.1-1986
 - 4. Americans with Disabilities Act Accessibility Guidelines
 - 5. Florida Department of Community Affairs Accessibility Requirements Manual
 - 6. National Electrical Code NFPA 70-2014
 - 7. Applicable State and Local Codes
 - 8. National Bureau of Fire Underwriters
 - 9. The Serving Utility Companies
 - 10. Florida Building Code 2017-Building
 - 11. Florida Building Code 2017-Mechanical
 - 12. Florida Building Code 2017-Plumbing
 - D. All material and equipment for the electrical system and the electrical portion of the mechanical systems shall bear the approval label, or shall be listed by, Underwriters' Laboratories, Inc.
 - E. Refer to General Conditions and Supplemental General Conditions, regarding any required permits and fee payments.

PART 2 - EXECUTION

2.1 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 1 through 26 for rough-in requirements.

2.2 ELECTRICAL INSTALLATIONS:

- A. Coordinate electrical equipment and materials installation with other building components. Verify all dimensions by field measurements.
- B. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
- C. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- E. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- F. Where mounting heights are not detailed or dimensioned, install electrical services and overhead equipment to provide the maximum headroom possible.
- G. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- H. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
- I. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

2.3 COOPERATION WITH OTHER TRADES:

- A. The Subcontractor shall give full cooperation to other trades and shall furnish in writing to the Contractor, with copies to the Engineer, any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. Where the work of the Subcontractor will be installed in close proximity to, or will interfere with work or other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Subcontractor shall prepare composite working drawings and sections at suitable scale, not less than 1/4" = 1'0", clearly showing how his work is to be installed in relation to the work of other trades. If the Subcontractor installs his work before coordinating with other trades, or so as to cause

any interference with work of other trades, he shall make the necessary changes in his work to correct the conditions without extra charge.

- C. The Subcontractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

2.4 TEMPORARY ELECTRICAL SERVICE

- A. Electrical contractor shall coordinate with the General Contractor concerning any work required on his part to provide temporary power to all contractors.

2.5 SCAFFOLDING, RIGGING, HOISTING:

- A. The Subcontractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

2.6 CUTTING AND PATCHING:

- A. This Article specifies the cutting and patching of electrical equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.
- B. Refer to CUTTING AND PATCHING for general requirements for cutting and patching.
- C. Refer to Division-23 Section: BASIC MECHANICAL REQUIREMENTS for requirements for cutting and patching mechanical equipment, components, and materials.
- D. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- E. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
- F. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- G. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective Work;
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed Work as specified for testing;
 - 5. Install equipment and materials in existing structures;
- H. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
- I. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work. Deliver all salvageable equipment to Owner.

- J. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- K. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

2.7 SLEEVES AND PLATES:

- A. This Subcontractor shall provide access doors and locate all sleeves and access doors and other inserts required before the floors and walls are built, or shall be responsible for the cost of cutting and patching required for conduits where sleeves and inserts were not installed, or where incorrectly located. The Subcontractor shall do all drilling required for the installation of his hangers.
- B. Sleeves shall be provided for all conduit passing through above grade concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves passing through above grade floors shall be sealed watertight.
- C. Where sleeves are placed in exterior walls below grade, the space between the conduit and the sleeves shall be made completely watertight.
- D. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of the conduit. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
 - 1. Terminate sleeves flush with walls, partitions and ceiling.
 - 2. In areas where pipes are concealed, as in chases, terminate sleeves 1" above floor.
 - 3. In all areas where pipes are exposed, extend sleeves 2" above finished floor.
- E. All sleeves shall be constructed of Schedule 40 steel pipe.
- F. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into the space between pipe and sleeve during construction.

2.8 PENETRATIONS:

- A. All penetrations through a fire barrier will be protected by a method rated in the 2012 Life Safety Code Book 101, Section 8.3.

2.9 ELECTRICAL SUBMITTALS:

- A. Refer to the Conditions of Contract (General, Supplementary and Specials), 8.8 Shop Drawings, Product Data and Samples for submittal definitions, requirements, and procedures.
- B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed.
- C. The Subcontractor shall submit for approval detailed shop drawings of all equipment and all material required to complete the project, and no material or equipment may be delivered to the job site or installed until the Subcontractor has in his possession the

approved shop drawings for the particular materials or equipment. The Shop drawings shall be complete as described herein. The Subcontractor shall furnish the number of copies required by the General and Special Conditions of the Contract, but in no case less than six (6) copies.

- D. Samples, drawings, specifications, and catalogs submitted for approval, shall be properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, contractor's name, and name of job.
- E. Catalogs, pamphlets or other documents submitted to describe items on which approval is being requested, shall be specified and identification in catalog, pamphlet, etc. of item shall be clearly made in ink. Data of a general nature will not be accepted.
- F. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed for compliance, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the Subcontractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications.
- G. Shop drawings and submittal are required on all conduit and fittings, wire, wiring devices, overcurrent devices, panelboards, disconnect switches, light fixtures, fire detection and alarm system components, etc as well as any other item at the discretion of the Engineer-of-Record. All submittals consisting of more than three items or pages shall have a table of contents listing the complete catalog number of each item submitted.

2.10 PRODUCT OPTIONS AND SUBSTITUTIONS:

- A. Refer to the Instructions to Bidders and and the Genral, Supplemental and Specials Condition, "or Equal" and Substitutions requirements in selecting products and requesting substitutions.
- B. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name or catalog number shall be provided as specified.
- C. Approvals of "or equivalent" substitutions will be used through eProcure to all bidders as an addendum to the Contract Documents. Any Contractor wishing to submit for an "or equivalent" substitution will submit with his request complete catalog information to permit evaluation of the product and in the case of lighting fixtures ITL, not manufacturers, test reports shall accompany the request.

2.11 PRODUCT LISTING:

- A. Prepare listing of major electrical equipment and materials for the project. Provide all information requested. Submit this listing as a part of the submittal requirement specified in the General Supplemental and Special Conditions, "Or Equal" and Substitutions Section.
- B. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.
- C. Provide products, which are compatible within systems and other connected items.

2.12 NAMEPLATE DATA:

- A. Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.13 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

2.14 RECORD DOCUMENTS:

- A. Refer to the General, Supplemental, & Special conditions Section "Final Completion and Acceptance Requirements" for requirements. The following paragraphs supplement the requirements of General, Supplemental and Special Conditions.
- B. Revise drawings to indicate changes to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned from column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices, etc. Record drawings shall be produced on AutoCAD V2010, or greater.
- C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

2.15 OPERATION AND MAINTENANCE DATA:

- A. Refer to the General, Supplemental and Specials Conditions Section: Manufacturer Instructions and Services, Substantial Completion, Final Acceptance and Final Completion and Acceptance Requires for procedures and requirements for preparations and submittal of maintenance manuals.
- B. In addition to the information required by General, Supplemental and Specials Conditions for Maintenance Data, include in an organized format the following information:
- C. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
- D. Manufacturer's printed operating procedures to include start- up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

- E. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
- F. Servicing instructions and lubrication charts and schedules.

2.16 WARRANTIES:

- A. Refer to the General, Supplemental and Specials Conditions Section: Warrant and Guarantee Provisions for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties specified in Division-26, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include product or equipment to include data of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

2.17 CLEANING:

- A. Refer to the General, Supplemental and Specials Conditions Section: FINAL ACCEPTANCE for general requirements for final cleaning.
- B. Clean all light fixtures, lamps, reflectors and lenses prior to final acceptance. Replace all inoperative lamps.

2.18 MATERIAL AND WORKMANSHIP:

- A. Electrical Contractor is generally responsible to insure all work, both old and new, complies with the NEC and any applicable state codes and ordinances.
- B. Electrical Contractor shall verify that all conduit and fittings to remain are sound and are solidly connected. Insure all conduit supports are adequate. Remove all wire from any abandoned circuits, capping any abandoned conduit and/or any openings.
- C. The Electrical Contractor shall insure the integrity of the service entrance grounding system by checking all connections for proper tightness and remaking as necessary.
- D. All materials and apparatus required for the work, except as specifically specified otherwise, shall be new, of first class quality, and shall be furnished, delivered, erected, connected and finished in every detail and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article, as approved by the Engineer, shall be furnished.
- E. The Electrical Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the installation of the work, together with all skilled workmen, fitters, metal workers, welders, helpers, and labor required to unload, transfer, erect, connect up, adjust, start, operate and test each system. Additionally, the Electrical Contractor shall comply with the State Public Works Compliance Act, Section 446.101, Florida Statutes, which is hereby interpreted to require, but not be limited to the following:
 - 1. Participate in registered training programs with the State of Florida.
 - 2. Hire for the duration of the contract a ration of apprentices of at least one apprentice or trainee to every five journeymen working on the project.

3. Submit a letter of intent prior to the starting date of the contract to the bureau of Apprenticeship, Department of Commerce and to others, as required by law.
 4. Prepare and submit quarterly to the Bureau of Apprenticeship records of employment on report Form BAP-500.
- F. Unless otherwise specifically indicated on the plans or specifications, all equipment and materials shall be installed with the approval of the Engineer in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.
- G. The Engineer shall be the final interpreter of the plans and the suitability of the workmanship of the installation(s). The Electrical Contractor shall remove, replace, and otherwise correct as directed any work determined to be deficient at no additional cost to the Owner.
- H. Provide start-up testing and instruct owner's personnel on operation of all equipment, without cost.
- 2.19 RECORD DRAWINGS:
- A. During the course of construction and the Subcontractor shall keep an accurate record of all deviations and changes of the work as indicated on the drawings and its actual installation.
- B. This Contractor shall provide as-built record drawings (reproducible) before final payment will be issued. As-built drawings shall be the same scale as the original design drawings and of good drafting or ACAD quality. As-built drawings shall contain the following information about the installing contractor:
1. Company Name
 2. Contractor Identification Number
 3. Principal Contact Name
 4. Address
 5. Telephone Number
 6. Fax Number
 7. Date of Completion

END OF SECTION 26 05 00

SECTION 26 05 02 - ELECTRICAL RELATED WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Electrical Requirements section, and is part of each Division-16 section making reference to electrical related work specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical related work required by this section is indicated on drawings and schedules, and/or specified in other Division-26 sections.
- B. Types of electrical related work specified in this section include the following:
 - 1. Access to Electrical Work:
 - a. Access doors in walls, ceilings, and floors.
 - b. Removable cover plates in walls, ceilings, and floors.
 - 2. Excavating for Electrical Work:
 - a. Underground electrical conduit and wiring.
 - 3. Concrete for Electrical Work:
 - a. Lean concrete backfill to support electrical work.
 - b. Encasement of electrical work.
 - c. Underground structural concrete to accommodate elect. work.
 - d. Electrical equipment foundations, mounting and housekeeping pads.
 - e. Rough grouting in and around electrical work.
 - f. Patching concrete, which has been cut to accommodate electrical work.
- C. Access requirements within electrical work, to electrical or electrical components within work, are specified in other Division-26 sections; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Concrete Work Codes and Standards: Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards; whichever is most stringent in its application to work in each instance:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 311 "Recommended Practice for Concrete Inspection".
 - 3. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 4. ACI 347 "Recommended Practice for Concrete Formwork".
 - 5. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 6. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

1.4 PROJECT CONDITIONS:

- A. Existing Utilities: Locate and protect existing utilities and other underground work in manner, which will ensure that no damage or service interruption will result from excavating and backfilling.
- B. Protect property from damage, which might result from excavating and backfilling.
- C. Protect persons from injury at excavations, by barricades, warnings and illumination.
- D. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

PART 2 - PRODUCTS

2.1 ACCESS TO ELECTRICAL WORK:

- A. Access Doors:
 - 1. General: Where walls and ceilings must be penetrated for access to electrical work, provide types of access doors indicated or required, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
 - 2. Access Door Construction: Report to appropriate Section(s) of these specifications.

2.2 EXCAVATING FOR ELECTRICAL WORK:

- A. SOIL (BACKFILL) MATERIALS:
 - 1. Satisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups, GW, GP, GM, SM, SW and SP.
 - 2. Unsatisfactory soil materials are defined as those complying with ASTM D 2487 soil classification groups GX, SC, ML, MH, CL, CH, OL, OH and PT.
 - 3. Subbase Material: Graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or manufactured sand.
 - 4. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing a 3/8" sieve.
 - 5. Backfill and Fill Material: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.
 - 6. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100% passing a 1- 1/2" sieve and not more than 5% passing a No. 4 sieve.

2.3 MATERIALS OF CONCRETE WORK:

- A. Form Materials and Construction:
 - 1. Refer to appropriate section(s) of these specifications.
- B. Concrete Materials:
 - 1. Refer to appropriate section(s) of these specifications.

C. CONCRETE MIXING:

1. Refer to appropriate section(s) of these specifications.

PART 3 - EXECUTION

3.1 ACCESS TO ELECTRICAL WORK:

- A. Install access units where indicated, in accordance with manufacturer's written instructions, in compliance with NEC, and with recognized industry practices.
- B. Coordinate with other work, including substrate construction work, as necessary to interface installation of access units with other work.
- C. Locate each removable access unit accurately in relation to electrical work requiring access.
- D. Provide adequate temporary support or attachment to framing or formwork, so that units will not be dislocated during construction of substrates.
- E. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- F. Adjust hardware and panels after installation for proper operation.
- G. Remove and replace panels or frames, which are warped, bowed, or damaged.

3.2 EXCAVATING AND ELECTRICAL WORK:

- A. General: Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum.
- B. Excavate with vertical-sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work. Adhere to all OSHA and Trench Act requirements.
- C. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at bottom of excavations:
 1. Single conduit of 5" and less nominal size.
 2. Cast-in-place concrete.
 3. Flat-bottomed multiple-duct conduit units.
- D. Depth for Subbase Support: Where installation of subbase material is indicated, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.
- E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

- F. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - G. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
 - H. Excavations for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.
 - I. Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.
 - J. For pipes or conduit 5" or less in nominal size and for flat- bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 - K. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.
 - L. Grade bottoms of trenches as indicated, notching under conduit couplings to provide solid bearing for entire body of conduit.
 - M. Depth for Unsatisfactory Soil Conditions: Where directed (because of unsatisfactory soil condition at bottom of indicated excavation), excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth. Refer to Division 1 for change order procedure on additional work, including additional excavating and backfilling.
 - N. Store excavated material (temporarily) near excavation, in manner, which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
 - O. Retain excavated material, which complies with requirements for backfill material.
 - P. Dispose of excavated material, which is either in excess of quantity, needed for backfilling or does not comply with requirements for backfill material.
 - Q. Move unused material to another location on Owner's property, at or adjacent to project site, and dispose of as directed by Architect/Engineer.
- 3.3 DEWATERING:
- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
 - C. Maintain dry excavations for electrical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers, which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through electrical work excavations.

- D. Install and operate well-point dewatering system to maintain ground water at level approximately 2'-0" below electrical work excavations, until backfilling is completed.

3.4 BASE PREPARATION:

- A. Subbase Installations: Where indicated, install subbase material to receive electrical work, and compact by tamping to form a firm base for the work. For horizontal cylindrical work, shape subbase to fit shape of bottom 90° of cylinder, for uniform continuous support.
- B. Provide finely-graded subbase material for wrapped, coated and plastic materials to be buried.
- C. Install drainage fill where required, and tamp to uniform firm density.
- D. Concrete Encasement: Where conduit under roadways is less than 2'-6" below surface of roadway, provide 4" base slab of concrete. After conduit piping is installed and checked, provide minimum 4" thick encasement (sides and top) of concrete before backfilling or placement of roadway subbase. Provide Class 2500 concrete for encasement and slab.
- E. Previous Excavations: Where conduit crosses over areas more than 5'-0" wide which have been previously excavated to greater depth than required for conduit installation, provide suitable subsidence-proof support; comply with requirements for placing subbase material.

3.5 BACKFILLING:

- A. General: Except as otherwise indicated, backfill with properly qualified backfill material.
- B. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic materials.
- C. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities.
- D. Backfill simultaneously on opposite sides of electrical work, and compact simultaneously; do not dislocate the work from installed positions.
- E. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the required densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
- F. Lawn/Landscaped Areas: Refer to appropriate section(s) of these specifications.
- G. Paved Areas, Other Than Roadways: Refer to appropriate section(s) of these specifications.
- H. Roadways: Refer to appropriate section(s) of these specifications.
- I. Backfill to elevations matching adjacent grades, at time of backfilling excavations for electrical work.
- J. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

- K. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of conduit/pipe systems.
- L. Compaction Tests: Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re- excavation and backfilling where necessary) and provide additional testing as directed by Engineer. The allowable density tolerance is not more than one-test-out-of-5 falling more than 2 percentage points below specified density.

3.6 PERFORMANCE AND MAINTENANCE, EXCAVATION WORK:

- A. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 INSTALLATION OF CONCRETE WORK:

- A. For all concrete installations refer to appropriate section(s) of these specifications.

END OF SECTION 26 05 02

SECTION 26 05 19 - WIRES AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division-22, 23 and 26 section making reference to electrical wires and cables specified herein.

1.2 DESCRIPTION OF WORK:

- A. Types of electrical wire, cable, and connectors specified in this section include the following:
 - 1. Copper conductors.
- B. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For power distribution circuits.
 - 2. For lighting circuits.
 - 3. For appliance, equipment, and motor-branch circuits.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color-coding of electrical wires and cables.
- B. UL Compliance: Provide wiring/cablings and connector products which are UL-listed and labeled.
- C. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std. Pub/No.'s WC 5, "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy", and WC-30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- D. IEEE Compliance: Comply with applicable requirements of IEEE Stds 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical wires, cables and connectors.

PART 2 - PRODUCTS

2.1 WIRES, CABLES, AND CONNECTORS:

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- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
- B. Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features, which fulfill project requirements.
- C. Type XHHW-2: For wet locations; max operating temperature 75°C (167°F). Insulation, flame-retardant, cross- linked synthetic polymer; conductor, annealed copper.
- D. Type THHN: For dry locations; max operating temperature 90°C (194°F). Insulation, flame-retardant, cross- linked synthetic polymer; conductor, annealed copper.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRES AND CABLES:

- A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Install UL Type XHHW-2/THHN wiring in conduit, for feeders and branch circuits. All feeders shall be continuous without splices.
- D. Pull conductors simultaneously where more than one is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary; compound must not deteriorate conductor or insulation.
- F. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.
- G. Keep conductor splices to minimum. Do not splice underground feeder conductors.
- H. Install splices and taps which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.
- I. Use splice and tap connectors, which are compatible with conductor material.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

3.2 FIELD QUALITY CONTROL:

- A. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. The electrical contractor shall review the entire electrical system grounding and provide remedial work, including any necessary components wiring, etc. as required to provide a code approved grounding system.
- B. Types of grounding specified in this section include the following:
 - 1. Solid grounding.
- C. Applications of grounding work in this section include the following:
 - 1. Enclosures.
 - 2. Equipment.
- D. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products, which are UL-listed and labeled.
- B. UL Compliance: Comply with applicable requirements of UL Standards Nos. 467 and 869 pertaining to electrical grounding and bonding.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on grounding systems and accessories.
- B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Handle electrical grounding accessories and components carefully to avoid damage; store in original wrappings and protect from dirt and weather.

PART 2 - PRODUCTS

- A. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.
- B. General: Provide raceways, and electrical boxes and fittings complying with Division-26 Basic Materials and Methods sections "Raceways" and "Electrical Boxes and Fittings", in accordance with the following listing:
 - 1. Rigid steel conduit.
 - 2. Electrical metallic tubing.
 - 3. Flexible metal conduit, Type 2.
 - 4. Liquid-tight flexible metal conduit.
 - 5. Rigid metal conduit fittings.
 - 6. Liquid-tight flexible metal conduit fittings.
- C. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.
- D. Bonding Jumper Braid: Copper braided tape, constructed of 30- gage bare copper wires and properly sized for indicated applications.
- E. Flexible Jumper Strap: Flexible flat conductor, 490 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolt hole ends with holes sized for 3/8" dia. bolts.
- F. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers as required for indicated applications.
- G. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Installer must examine areas and conditions under which electrical grounding connections are to be made and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL GROUNDING:

- A. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.
- C. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical grounding systems, test ground resistance with ground resistance tester. Where tests show resistance to ground is over 10 ohms, take appropriate action to reduce resistance to 10 ohms, or less, by supplementing existing ground rods, etc.; then retest to demonstrate compliance.

END OF SECTION 26 05 26

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to supports, anchors, sleeves, and seals specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, sleeves and seals is specified in other Division-26 sections.
- B. Types of supports, anchors, sleeves and seals specified in this section include the following:
 - 1. Clevis hangers.
 - 2. Riser clamps
 - 3. C-clamps
 - 4. I-beam clamps
 - 5. One-hole conduit straps
 - 6. Two-hole conduit straps
 - 7. Round steel rods
 - 8. Lead expansion anchors
 - 9. Toggle bolts
 - 10. Wall and floor seals.
- C. Supports, anchors, sleeves and seals furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-26 sections.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.
- B. MSS Compliance: Comply with applicable MSS standard requirements pertaining to fabrication and installation practices for pipe hangers and supports.
- C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- D. UL Compliance: Provide electrical components, which are UL-listed and labeled.
- E. FS Compliance: Comply with Federal Specification FF-S-760 pertaining to retaining strap for conduit, pipe and cable.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specification, and installation instructions, for each type of support, anchor, sleeve and seal.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

- A. General: Provide supporting devices, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of device meets indicated requirements, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
- C. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" dia. hole for round steel rod; approx. 54 pounds per 100 units.
- D. Riser Clamps: For supporting 5" rigid metal conduit; black steel; with 2 bolts and nuts, and 4" ears; approx. 510 pounds per 100 units.
- E. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8"; black steel; approx. 16 pounds per 100 units.
- F. C-Clamps: Black malleable iron; 1/2" rod size; approx. 70 pounds per 100 units.
- G. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.
- H. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approx. 7 pounds per 100 units.
- I. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
- J. Hexagon Nuts: For 1/2" rod size; galvanized steel; approx. 4 pounds per 100 units.
- K. Round Steel Rod: Black steel; 1/2" dia.; approx. 67 pounds per 100 feet.
- L. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approx. 200 pounds per 100 units.
- M. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features:
- N. Lead Expansion Anchors: 1/2"; approx. 38 pounds per 100 units.
- O. Toggle Bolts: Springhead; 3/16" x 4"; approx. 5 pounds per 100 units.
- P. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated; and having the following construction features:
- Q. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through

concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

- R. Provide fire stopping where conduits pass through fire rated wall, ceiling, floor, etc. Fire stopping shall be approved for the assembly encountered.
- S. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 16-gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:
 - 1. Fixture hangers.
 - 2. Channel hangers.
 - 3. End caps.
 - 4. Beam clamps.
 - 5. Wiring stud.
 - 6. Thinwall conduit clamps.
 - 7. Rigid conduit clamps.
 - 8. Conduit hangers.
 - 9. U-bolts.

2.2 FABRICATED SUPPORTING DEVICES:

- A. Pipe Sleeves: Provide pipe sleeves of one of the following:
- B. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gage metal: 3" and smaller, 20-gage; 4" or 6", 16-gage; over 6", 14-gage.
- C. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
- D. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
- E. Plastic-Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
- F. Sleeve Seals: Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Calk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Provide fire stopping as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, seals and fire stopping as indicated or required, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacings indicated and in compliance with NEC requirements.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

- A. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Rigid metal conduit.
 - 5. Rigid nonmetallic conduit.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards:
 - 1. NEMA Compliance: Comply with applicable portions of NEMA Standards Publications pertaining to raceways.
 - 2. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components, which have been UL-listed and labeled.
 - 3. NEC Compliance: Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING:

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- B. Rigid Steel Conduit: Provide rigid steel, zinc-coated, threaded type conforming to FS WW-C-0581, ANSI C80.1 and UL 6. Provide zinc coating fused to inside and outside walls.

- C. Flexible Metal Conduit: FS WW-C-566 and UL 1. Formed from continuous length of spirally wound, interlocked and double wrapped strip steel, galvanized inside and out.
 - D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
 - E. Rigid Metal Conduit Fittings: Provide steel or malleable iron, galvanized inside and out. All rigid fittings shall be threaded type.
 - F. Locknuts: Provide steel bonding low voltage locknuts with insulating bushings at all box connections. Provide steel bonding locknuts and insulated throat grounding bushings with ground lug at all power distribution boxes and cabinets.
 - G. Combination Couplings: Provide malleable iron threaded rigid to EMT set screw couplings with insulated throat.
 - H. Elbows: Provide malleable iron long sweep fittings for all rigid conduit systems.
 - I. Flexible Metal Conduit Fittings: Provide conduit fittings galvanized inside and out for use with flexible steel conduit.
 - J. Straight Terminal Connectors: One-piece body, insulated throat screw in with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
 - K. 45° or 90° Terminal Angle Connectors: Two-piece body construction with removable upper section, female end with clamp and two deep slotted machine screws for securing conduit, and male threaded end provided with locknut.
 - L. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, steel fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or non-insulated throat.
 - M. Electrical Metallic Tubing (EMT): Provide steel EMT conduit fittings galvanized inside and out. All EMT fittings shall be set concrete tight screw type.
 - N. EMT Fittings:
 - 1. Couplings: Provide couplings up to 1" with single set screw per conduit end. Provide all other sizes with two set screws per conduit end.
 - 2. Connectors: Provide insulated throat steel, one screw (up to 1") or two screw (above 1") with grounding bushing.
- 2.2 NONMETALLIC CONDUIT AND DUCTS:
- A. General: Provide nonmetallic conduit and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, which comply with portions of NEC for raceways.
 - B. PVC Conduit and Tubing Fittings: NEMA TC 3, match and match to conduit or tubing type and material.

- C. Conduit, and Tubing Accessories: Provide conduit and tubing accessories of types, sizes and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.
- D. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded- conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which raceways are to be installed, and substrate, which will support raceways. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CONDUITS:

- A. General: Install concealed conduits in new construction work, either in walls, slabs, or above hung ceilings. Run conduits concealed in existing work where practicable. Where conduits cannot be concealed in finished areas, use surface metal raceways.
- B. Mechanically fasten together metal conduits, enclosures, and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.
- C. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
- D. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed.
- E. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades. Provide nylon pull cord in empty conduits where indicated. Test conduits required to be installed, but left empty, test with ball mandrel. Clear any conduit, which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
- F. Conduit Installation: Provide schedule 40 PVC conduit where embedded in concrete, masonry, or earth. Follow minimum requirements in other areas as follows:
- G. Use rigid steel zinc-coated conduit whenever exposed up to 10' above finished elevation in mechanical equipment rooms, electrical equipment rooms, and storage rooms.
- H. Use steel zinc-coated EMT conduit in offices, corridors, toilets, breakroom areas, and in storage spaces above 10'-0" height.
- I. Use flexible conduit in movable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connection to motors, or control items subject to movement or vibration.

- J. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
 - 1. Exterior location.
 - 2. Moist or humid atmosphere where condensate can be expected to accumulate; unconditioned spaces.
 - 3. Equipment rooms.
 - 4. Corrosive atmosphere.
 - 5. Subjected to water spray or dripping oil, water or grease.

- K. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean. Use field-bend conduit benders designed for purpose so as not to distort nor vary internal diameter.

- L. Size conduits to meet NEC, except no conduit smaller than 3/4 inch shall be embedded in concrete or masonry.

- M. Fasten conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosures.

- N. Conduits are not to cross pipe shafts, or ventilating duct openings.

- O. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

- P. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.

- Q. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

- R. All rigid conduit systems shall use threaded couplings. When changing from PVC underground to rigid in equipment rooms, make transition underground so only rigid is exposed in room.

- S. Do not use "handy" EMT elbows. Field bends or use junction boxes.

- T. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

- U. Exposed Conduits:
 - 1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
 - 2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
 - 3. Support exposed circuits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed following: up to 1"; 6'-0"; 1-1/4" and over: 8'-0".
 - 4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
 - 5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings, and in crawl spaces.

- V. Non-Metallic Conduits:

1. Make solvent-cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.

W. Conduit Fittings:

1. Install locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening. Torque bonding screw to provide good contact with metal.
2. Bushings for terminating conduits are to have insulated throats to prevent injury to cable insulation.
3. Bushings to have screw type grounding terminal.
4. Miscellaneous fittings such as reducers, chase nipples, 3- piece unions, split couplings, and plugs to be specifically designed for their particular application.

END OF SECTION 26 05 33

260534 ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK:

- A. Types of electrical boxes and fittings specified in this section include the following:
 - 1. Outlet boxes.
 - 2. Junction boxes.
 - 3. Pull boxes.
 - 4. Bushings.
 - 5. Locknuts.
 - 6. Knockout closures.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- B. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings, which are UL-listed and labeled.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and Pub 250 pertaining to outlet and device boxes, covers and box supports.
- D. Federal Specification Compliance: Comply with applicable requirements of FS-W-C-586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies and Entrance Caps".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical boxes and fittings.
- B. Shop Drawings: Submit layout drawings of electrical floor, junction and pull boxes showing accurately scaled box layouts and their spatial relationship to associated equipment.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

- A. Outlet Boxes: Provide galvanized flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and

conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion-resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

- B. **Outlet Box Accessories:** Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and to fulfill installation requirements for individual wiring situations.
- C. **Device Boxes:** Provide galvanized coated flat rolled sheet-steel non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps, and for equipment type grounding.
- D. **Device Box Accessories:** Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
- E. **Junction and Pull Boxes:** Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- F. **Bushings, Knockout, Closures and Locknuts:** Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

- A. **General:** Install electrical boxes and fittings, as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- D. Install electrical boxes in those locations to ensure ready accessibility to enclosed electrical wiring.
- E. Do not install boxes back-to-back in walls. Provide not less than 6" (150 mm) separation. Position recessed outlet boxes accurately to allow for surface finish thickness.
- F. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- G. Provide electrical connections for installed boxes.

H. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.2 GROUNDING:

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION 26 05 34

SECTION 26 05 35 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and are part of each Division-22, 23 and 26 section making reference to electrical connections for equipment specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section includes the following:
 - 1. To resistance heaters.
 - 2. From electrical source to motor starters/disconnect switches.
 - 3. From motor starters/disconnect switches to motors.
 - 4. To lighting fixtures.
 - 5. To grounds including earthen connections.
 - 6. To all units of communication, signal, alarm, public address, and sound systems.
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division-23 and other Division-26 sections, and are work of this section.
- D. Motor starters and controllers, not furnished as integral part of equipment or by others, are specified in applicable Division-26 sections, and are work of this section.
- E. Refer to Division-23 sections for motor starters and controllers furnished integrally with equipment or by Division 23 contractor; not work of this section.
- F. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division-26 sections, and are work of this section.
- G. Electrical identification for wire/cable conductors is specified in Division-26 section, "Electrical Identification", and is work of this section.
- H. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division-26 sections, and are work of this section.
- I. Refer to other Division-26 sections for junction boxes and disconnect switches required for connecting motors and other electrical units of equipment; not work of this section.
- J. Refer to Division-23 sections for control system wiring; not work of this section.

- K. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 2 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.
- D. IEEE Compliance: Comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
- E. ANSI Compliance: Comply with applicable requirements of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
- F. UL Compliance: Comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL-listed and -labeled.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical connectors, terminals, and materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to, the following:
 1. AMP Incorporated.
 2. Atlas Technologies, Inc.
 3. Burndy Corporation.
 4. Gould, Inc.
 5. Harvey Hubbell Inc.
 6. Ideal Industries, Inc.
 7. Thomas and Betts Corp.

2.2 MATERIALS AND COMPONENTS:

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable

insulating tubing, cable ties, solderless wire- nuts, and other items and accessories as needed to complete splices and termination of types indicated.

B. Metal Conduit, Tubing and Fittings:

1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division-26 basic electrical materials and methods section "Raceways", and in accordance with the following listing of metal conduit, tubing and fittings:
 - a. Rigid steel conduit.
 - b. Rigid metal conduit fittings.
 - c. Electrical metallic tubing.
 - d. EMT fittings.
 - e. Flexible metal conduit.
 - f. Flexible metal conduit fittings.
 - g. Liquid-tight flexible metal conduit.
 - h. Liquid-tight flexible metal conduit fittings.

C. Wires, Cables, and Connectors:

1. General: Provide wires, cables, and connectors complying with Division-26 basic electrical materials and methods section "Wires and Cables".
2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections, which match, including sizes and ratings, of wires/cables, which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
3. Connectors and Terminals: Provide electrical connectors and terminals, which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

D. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- E. Cover Splices with electrical insulating material equivalent to, or of greater insulation resistance rating, than electrical insulation rating of those conductors being spliced.
- F. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes, which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- H. Tighten connectors and terminals; including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
- I. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.
- J. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:
 - 1. Exterior location.
 - 2. Moist or humid atmosphere where condensate can be expected accumulate.
 - 3. Corrosive atmosphere.
 - 4. Water spray.
 - 5. Dripping oil, grease, or water.
- K. Fasten identification markers to each electrical power supply wire/cable conductor, which indicates their voltage, phase and feeder number in accordance with Division-16 section "Electrical Identification". Affix markers on each terminal conductor, as close as possible to the point of connection.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and

compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 26 05 35

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of mechanical identification work required by this section is specified in other Division-26 sections. It is the intent of these specifications to provide a complete identification system(s) for all Division 26 work, both new and existing. Contractor(s) is responsible to review all existing installations and provide proper identification.
- B. Types of electrical identification work specified in this section include the following:
 - 1. Electrical power, control and communication conductors.
 - 2. Operational instructions and warnings.
 - 3. Danger signs.
 - 4. Equipment/system identification signs.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring equipment.
- B. UL Compliance: Comply with applicable portions of UL safety standards pertaining to electrical marking and labeling identification systems.
- C. ANSI Compliance: Comply with applicable requirements of ANSI Std A13.1, "Scheme for the Identification of Piping Systems".
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical identification materials and products.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIALS:

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Colors: Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.
- C. Baked Enamel Danger Signs:
 - 1. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.
- D. Engraved Plastic-Laminate Signs:
 - 1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- E. Thickness: 1/8", except as otherwise indicated.
- F. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.2 LETTERING AND GRAPHICS:

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

- A. General Installation Requirements:
 - 1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
 - 2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
 - 3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- B. Operational Identification and Warnings:
 - 1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems

and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

C. Danger Signs:

1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
2. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
3. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

D. Equipment/System Identification:

1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1- 1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work.
 - a. Panelboards, electrical cabinets and enclosures.
 - b. Access panel/doors to electrical facilities.
 - c. Major electrical switchgear.
 - d. Telephone switching equipment.
 - e. Transformers

E. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

F. Refer to other sections for specific identification requirements for special systems.

G. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided or where in the circuits' originating enclosure. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work. Contractor shall permanently and legibly identify all circuits (power distribution and/or low voltage) in each junction box by hand lettering on the covers and/or within 12" of all attached conduits.

H. Identify all fire alarm conduit by painting the junction boxes, etc. red.

END OF SECTION 26 05 53

SECTION 26 07 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Electrical Materials and Methods section, and is a part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems, which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles.
 - 2. Ground-fault circuit interrupters.
 - 3. Switches.
 - 4. Wallplates.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- B. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation of wiring devices. Provide wiring devices, which are UL-listed and labeled.
- C. IEEE Compliance: Comply with applicable requirements of IEEE Std 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to electrical wiring systems.
- D. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General-Purpose Wiring Devices", WD 2, "Semiconductor Dimmers for Incandescent Lamps", and WD 5, "Specific, -Purpose Wiring Devices".

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wiring devices, which may be incorporated in the work, include, but are not limited to, the following:
 - 1. Cooper Wiring Devices Inc.
 - 2. Hubbell, Inc.
 - 3. Leviton Mfg Co.

4. Pass and Seymour, Inc.
5. Wiremold Company.

B. Receptacles:

1. Heavy-Duty Single: Provide single heavy-duty type receptacles, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, 20-amperes, 125 volts, with metal plaster ears; design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5- 20R unless otherwise indicated.
2. Heavy-Duty Duplex: Provide heavy-duty duplex receptacles, 2-pole, 3-wire grounding, 20-amperes, 125-volts, with metal plaster ears, design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated.
3. Ground-Fault Interrupter: Provide "feed-thru" type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of protecting connected downstream receptacles on single circuit, and of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20-amperes, 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; equip with NEMA configuration 5-20R.

C. Switches:

1. Toggle: Provide general-duty flush single-pole quiet toggle switches, 20-ampere, 120-277 volts AC, with mounting yoke insulated from mechanism, equip with plaster ears, switchhandle, and side-wired screw terminals.
2. Single Pole: Provide general-duty flush single pole AC quiet switches, 20-amperes, 120-277 volts, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle, side-wired screw terminals, with break-off tab features, which allows wiring with separate or common feed.

2.2 WIRING DEVICE ACCESSORIES:

- A. Wallplates: Provide wallplates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; Provide plates possessing the following additional construction features:
1. Material and Finish: 0.04" thick, type 302 satin-finished stainless steel.
- B. Security Devices: Provide vandal-proof flush enclosure with a gasketed keyed locking cover. Provide two keys with each lock, similar to Pass and Seymour #4600. Use at all exterior locations of exposed receptacles, switches, microphone outlets and similar devices.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

- C. Install wiring devices only in electrical boxes, which are clean; free from excess building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Do not use pressure contacts for electrical connection. All connections shall be made on the screw terminals.
- F. Install wallplates after painting work is completed.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B. Use properly scaled torque indicating hand tool.

END OF SECTION 26 07 26

SECTION 26 24 10 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of service-entrance work is indicated by drawings and schedules.
- B. Panelboards, switchboards, disconnects, etc. used for service-entrance equipment are specified in other Division-26 sections, and are work of this section.
- C. Metering devices in accordance with utility requirements, including CT cabinets, meter bases, etc. and interconnecting conduit requirements.
- D. Telephone connections and required conduit, etc.
- E. Wires/cables, raceways, and electrical boxes and fittings are specified in Division-26 Basic Electrical Materials and Methods sections, "Wires and Cables", "Raceways", and "Electrical Boxes and Fittings".
- F. Refer to other Division-26 sections for wires/cables, raceways, and electrical Boxes and fittings work required in connection with service-entrance equipment; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of service-entrance equipment, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 5 years of successful installation experience with projects utilizing service entrance work similar to that required for this project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of service-entrance equipment and accessories.
- D. NEMA Compliance: Comply with construction and installation requirements of the following NEMA standards for service-entrance equipment and accessories:
 - 1. Std Pub No. AB 1; Molded-Case Circuit Breakers.
 - 2. Std Pub No. PB 2; Deadfront Distribution Switchboards/Panelboards.
- E. UL Compliance: Comply with construction and installation requirements of the following UL standards for service-entrance equipment and accessories:

1. UL 50; Electrical Cabinets and Boxes.
 2. UL 489; Molded-Case Circuit Breakers and Circuit-Breaker Enclosures.
 3. UL 854; Service-Entrance Cables.
 4. UL 869; Electrical Service Equipment.
 5. Provide service-entrance equipment and accessories, which are UL-listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT".
- F. IEEE Compliance: Comply with applicable requirements of IEEE Std 241 pertaining to service entrances.
- G. ANSI Compliance: Comply with ANSI C2, "National Electrical Safety Code", and installation requirements for aboveground service-entrance conductors.
- 1.4 SUBMITTALS:
- A. Product Data: Submit manufacturer's data on service-entrance equipment and accessories.
 - B. Shop Drawings: Submit dimensioned layouts of service-entrance equipment, including spatial relationships to proximate electrical equipment.
 - C. Wiring Diagrams: Submit power, signal and control wiring diagrams for service-entrance work. Clearly differentiate between portions of wiring/cabling that are manufacturer-installed and portions that are field-installed.

PART 2 - PRODUCTS

2.1 SERVICE-ENTRANCE EQUIPMENT:

- A. General: Provide service-entrance equipment and accessories; of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation, and as herein specified.
- B. Overcurrent Protective Devices: Provide molded case circuit breaker overcurrent protective devices rated in accordance with the panelboard schedule but in no event less than 22,000AIC rating.
- C. Cable/Wire:
 1. General: Provide cable/wire complying with Division-26 Basic Electrical Materials and Methods section "Wires and Cables", in accordance with the following listing:
 - a. Type XHHW-2, wet listed copper cable.
- D. Raceways:
 1. General: Provide raceways complying with Division-26 Basic Electrical Materials and Methods section "Raceways", in accordance with the following listing:
 - a. PVC Sch 40 underground w/EMT sweeps fittings and up to 10'.

PART 3 - EXECUTION

3.1 INSTALLATION OF SERVICE-ENTRANCE EQUIPMENT:

- A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service-entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.
- B. Coordinate with other electrical work, including utility company wiring, as necessary to interface installation of service-entrance equipment work with other work.

3.2 GROUNDING:

- A. Provide equipment bonding and grounding connectors, sufficiently tight to assure a permanent and effective ground, for service-entrance equipment and wiring/cabling as indicated.

3.3 ADJUST AND CLEAN:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.4 FIELD QUALITY CONTROL:

- A. Upon completion of installation of service-entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

END OF SECTION 26 24 10

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of panelboard, load-center, and enclosure work, including cabinets and cutout boxes is indicated by drawings and schedules.
- B. Types of panelboards and enclosures in this section include the following:
 - 1. Power-distribution panelboards.
 - 2. Lighting and appliance panelboards.
- C. Refer to other Division-26 sections for cable/wire, connectors and electrical raceway work required in conjunction with panelboards and enclosures; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards and enclosures, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC requirements pertaining to installation of wiring and equipment in hazardous locations.
- D. UL-Compliance: Comply with applicable requirements of Std No. 67, "Electrical Panelboards", and Stds No.'s 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures. Provide units, which are UL-listed and labeled.
- E. Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate UL marks, which indicates that special type of use/application.
- F. NEMA Compliance: Comply with NEMA Stds Pub/No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)", Pub/No. PB 1, "Panelboards", and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".
- G. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel", pertaining to panelboards and accessories.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on panelboards.
- B. Wiring Diagrams: Submit wiring diagrams for panelboards showing connections to electrical power feeders and distribution branches.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of panelboard and enclosure):
 - 1. General Electric Company
 - 2. Siemens, Inc.
 - 3. Square D Company
 - 4. Cutler-Hammer

2.2 PANELBOARDS:

- A. General: Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information; equip with proper number of unit panelboard devices a required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated. Panelboards shall be UL listed to interrupt the minimum symmetrical short circuit amperes as indicated on the schedules.
- B. Power Distribution Panelboards: Provide dead-front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for copper conductors. Select unit with feeder connecting at top of panel. Equip with copper bus bars with not less than 98% conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded-case (as required) circuit-breaker types with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panelboards with separate bare uninsulated grounding bars suitable for bolting to enclosures for equipment and isolated grounds. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards.
- C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for copper conductors; construct unit for connecting feeders at top of panel; equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, single-pole circuit-breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required; provide separate bare uninsulated grounding bars suitable for bolting to enclosures for equipment and isolated ground. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards.
- D. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed

piano door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures, which are fabricated by same manufacturer as panelboards, which mate properly with panelboards to be enclosed.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Installer must examine areas and conditions under which panelboards and enclosures are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF PANELBOARDS:

- A. General: Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC Standards and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate installation of panelboards and enclosures with cable and raceway installation work.
- C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- D. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- E. Provide properly wired electrical connections within enclosures.
- F. Type out panelboard's circuit directory card upon completion of installation work.

3.3 GROUNDING:

- A. Provide equipment grounding connections for panelboards as indicated. Tighten connections to comply with tightening torques specified in UL Stds 486A and B to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL:

- A. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications. Check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

END OF SECTION 26 24 16

SECTION 26 28 16 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. Types of overcurrent protective devices in this section include the following:
- B. Circuit Breakers:
 - 1. Molded-case.
- C. Fuses:
 - 1. Class L time-delay.
 - 2. Class L fast-acting.
 - 3. Class RK5 time-delay.
- D. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of overcurrent protective devices.
- B. UL Compliance: Comply with applicable requirements of UL 489, "Molded-Case Circuit Breakers and Circuit-Breaker Enclosures", and UL 198D, "High-Interrupting-Capacity Class K Fuses". Provide overcurrent protective devices which are UL-listed and labeled.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. AB 1, AB 2 and SG 3 pertaining to molded-case and low-voltage power type circuit breakers.
- D. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 pertaining to low-voltage cartridge fuses.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: amperes, voltages and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time-current trip characteristic curves, and mounting requirements.

PART 2 - PRODUCTS

2.1 CIRCUIT BREAKERS:

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
- B. Molded-Case Circuit Breakers: Provide factory-assembled, molded- case circuit breakers of frame and/or trim size indicated; 240-volts with number of poles indicated, 60 Hz; 22,000 RMS symmetrical amperes interrupting ratings; or series equivalent rated. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip button cover for mechanical tripping circuit breakers. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40°C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

2.2 FUSES:

- A. General: Except as otherwise indicated, provide fuses of types, sizes, and ratings, and average time/current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and construction in accordance with published product information, and with industry standards and configurations.
- B. Class L Time-Delay Fuses: Provide UL Class L time-delay fuses rated 600 V, 60 Hz, amperes as required, with 200,000 RMS symmetrical interrupting current rating for protecting transformers, motors, and circuit breakers.
- C. Class L Fast-Acting Fuses: Provide UL Class L fast-acting fuses rated 600 V, 60 Hz, amperes as required, with 200,000 RMS symmetrical interrupting current rating for protecting service entrances and main feeder circuit breakers.
- D. Class RK5 Time-Delay Fuses: Provide UL Class RK5 time-delay fuses rated 600 V, 60 Hz, amperes as required, with 200,000 RMS symmetrical interrupting current rating for protecting motors.

PART 3 - EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

- A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.
- C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.
- D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.

3.2 FIELD QUALITY CONTROL:

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits.
- B. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 28 16

SECTION 26 28 17 - CIRCUIT AND MOTOR DISCONNECTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Types of circuit and motor disconnect switches in this section include the following:
 - 1. Equipment disconnects.
 - 2. Appliance disconnects.
 - 3. Motor-circuit disconnects.
- B. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division-26 Basic Electrical Materials and Methods sections.
- C. Refer to other Division-26 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with circuit and motor disconnect work; not work of this section.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- B. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches". Provide circuit and motor disconnect switches which have been UL-listed and labeled.
- C. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub No. KS 1, "Enclosed Switches", and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.
- B. Shop Drawings: Submit shop drawings of electrical circuit and motor disconnect switches, which have ratings of 100 amperes and larger, showing accurately scaled switches, their layouts and proximity to associated equipment.

PART 2 - PRODUCTS

2.1 FABRICATED SWITCHES:

- A. Heavy-Duty Disconnect Switches: Provide surface-mounted, heavy duty type sheet-steel enclosed switches, of types, sizes, and electrical characteristics indicated; rated 480 or 240 volts, amperes as indicated on the plans, 60 Hz, with blades and poles as required; and incorporating spring assisted, quick-make, quick-break switches which are so constructed that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is capable of being padlocked in OFF position. Construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and stamped enclosure knockouts. Provide NEMA Type 1 or NEMA type 3R enclosure as indicated on the plans.
- B. Switches shall be horsepower rated for AC as specified on the drawings. All switches shall meet I square T requirements. All fusible switches shall have the capability of field conversion from standard Class H fuse spacing to Class J fuse spacing, without affecting the U.L. listing. The switch also must accept Class R fuses and have a field installed U.L. listed rejection feature to reject all fuses except Class R. U.L. listed short circuit ratings, when equipped with Class J or Class R fuses, shall be 200,000 amperes RMS symmetrical.
- C. Fuses: Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types, and ratings indicated on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES:

- A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate circuit and motor disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Install disconnect switches for use with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

3.2 GROUNDING:

- A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical disconnect switches where indicated.

3.3 FIELD QUALITY CONTROL:

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

END OF SECTION 26 28 17

SECTION 26 32 23 AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 SUMMARY

- A This section includes the following items from a single supplier:
 - 1. Automatic transfer switch
 - 2. Related Accessories as specified
- B Related Requirements
 - 1. It is the intent of this specification to secure an automatic transfer switch that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.
 - 2. Any exceptions to the published specifications shall be subject to the approval of the engineer and submitted minimum 10 days prior to the closing of the bid with a line by line summary description of all the items of compliance, any items that have been omitted or have been taken exception to, and a complete description of all deviations.
 - 3. It is the intent of this specification to secure an automatic transfer switch that has been tested during design verification, in production, and at the final job site. The automatic transfer switch will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
 - 4. All equipment shall be new and of current production by an international, power system manufacturer of generators, transfer switches, and paralleling switchgear. The manufacturer shall be a supplier of a complete and coordinated system. There will be single-source responsibility for warranty, parts, and service through a factory-authorized representative with factory-trained technicians.

1.2 SUBMITTALS

- A Action Submittals
 - 1. Product Data
 - a The submittal shall include specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.
 - 2. Shop Drawings
- B Informational Submittal
 - 1. Certificates
 - 2. Test and Evaluation Reports
 - 3. Manufacturer's Instruction
 - 4. Source Quality Control Submittals
 - 5. Field or Site Quality Control
 - 6. Manufacturer's Report
 - 7. Special Procedure Submittal
 - 8. Qualification Statement
- C Closeout Submittals
 - 1. Maintenance Contracts
 - 2. Operation And Maintenance Data

3. Bonds
 4. Warranty Documentation
 5. Record Documentation
 6. Software
- D Maintenance Material Submittals
1. Literature
 2. Spare Parts
 3. Extra Stock Materials
 4. Tools

1.3 Quality Assurance

- A Regulatory Agency
1. The automatic transfer switch shall conform to the requirements of the following codes and standards:
 - a UL 1008 - Standard for Transfer Switch Equipment
 - b IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - c NFPA 70 - National Electrical Code
 - d NFPA 99 - Essential Electrical Systems for Health Care Facilities
 - e NFPA 110 - Emergency and Standby Power Systems
 - f IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - g NEMA Standard ICS 10-2005, Electromechanical AC Transfer Switch Equipment.
 - h EN61000-4-4 Fast Transient Immunity Severity Level 4
 - i EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)
 - j IEEE 472 (ANSI C37.90A) Ring Wave Test
 - k IEC Specifications for EMI/EMC Immunity (CISPR 11, IEC 1000-4-2, IEC 1000-4-3, IEC 1000-4-4, IEC 1000-4-5, IEC 1000-4-6, IEC 1000-4-8, IEC 1000-4-11)
 - l CSA C22.2 No. 178 certification
 2. Qualifications
 - a The automatic transfer switch shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.
 - b A manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year shall produce the automatic transfer switch.
 3. Manufacturers
 - a The automatic transfer switch shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.
 - b The manufacturer shall maintain a national service organization of employing personnel located throughout the contiguous United States. The Service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
 - c The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

1.4 Field or Site Conditions

- A Ambient Conditions
1. Automatic transfer switch shall operate in the following conditions without any damage to the unit or its loads.

- a Ambient Temperature: -4 to 158 Degrees F
- b Relative Humidity: 5% to 95% noncondensing

1.5 Warranty or Bond

A Manufacturer's Warranty

1. The ATS shall include a standard warranty covering one (1) year to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from the date of initial startup.
2. The ATS manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and functional tests performed on all systems.

PART 2 PRODUCTS

2.1 Equipment

A Equipment

1. Furnish and install automatic transfer switches system(s) with 3-Pole / 4-Wire, Solid Neutral,
2. Amperage as shown on the construction documents, 208V/60Hz. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

B Automatic transfer switches shall be Kohler Any Breaker Rated - Standard Transition, KSS series

C Construction

1. The transfer switch shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism.
2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.
3. The switch shall be positively locked and unaffected by momentarily outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 800 amperes and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources, are not acceptable.
7. For two and three pole switches, where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.
8. For four pole switches with a switching neutral, where neutral conductors must be switched as shown on the plans, the contactor shall be provided with fully rated switched neutral transfer contacts. Overlapping neutral contacts may be used as an alternative.

D Enclosure

1. The ATS shall be furnished in a NEMA 1 enclosure.
2. All standard door mounted switches and indicating LEDs shall be integrated into a flush-mounted, interface membrane or equivalent in the enclosure door for easy viewing & replacement. The

panel shall be capable of having a manual locking feature to allow the user to lockout all membrane mounted control switches to prevent unauthorized tampering. This cover shall be mounted with hinges and have a latch that may be padlocked. The membrane panel shall be suitable for mounting by others when furnished on open type units.

2.2 Operation

A Controls

1. A four line, 20 character LCD display and dynamic 4 button keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and control through the communications interface port or USB. The following parameters shall only be adjustable via a password protected programming on the controller:
 - a Nominal line voltage and frequency
 - b Single or three phase sensing
 - c Operating parameter protection
 - d Transfer operating mode configuration (Standard transition, Programmed transition, or Closed transition)

B Voltage and Frequency

1. Voltage (all phases) and frequency on both the normal and emergency sources shall be continuously monitored. Voltage on both normal and emergency sources and frequency on the emergency sources shall be adjustable with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

a Parameter	Dropout/Trip	Pickup/Reset
b Under voltage	75 to 98%	85 to 100%
c Over voltage	06 to 135%	95 to 100% of trip
d Under frequency	95 to 99%	80 to 95%
e Over frequency	01 to 115%	105 to 120%
f Voltage unbalance	5 to 20%	3 to 18%
2. Repetitive accuracy of all settings shall be within $\pm 0.5\%$ over an operating temperature range of -20°C to 70°C .
3. An adjustable dropout time for transient voltage and frequency excursions shall be provided. The time delays shall be 0.1 to 9.9 seconds for voltage and .1 to 15 seconds for frequency.
4. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad, remotely via the communications interface port or USB.
5. The controller shall be capable of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or BAC). Unacceptable phase rotation shall be indicated on the LCD; the service required LED and the annunciation through the communication protocol and dry contacts. In addition, the phase rotation sensing shall be capable of being disabled, if required.
6. The controller shall be capable of detecting a single phasing condition of a source, even though a voltage may be regenerated by the load. This condition is a loss of phase and shall be considered a failed source.
7. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage on all 3 phases (phase to phase and phase to neutral), frequency, and phase rotation.

C Time Delays

1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 12 or 24 VDC power supply.
2. A time delay shall be provided on transfer to the emergency source, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

3. A time delay shall be provided on re-transfer to normal. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive external relay(s) for selective load disconnect and reconnect control. The controller shall be capable of controlling a maximum of 9 individual output time delays to step loads on after a transfer occurs. Each output may be individually programmed for their own time delay of up to 60 minutes. Each sequence shall be independently programmed for transferring from normal to emergency and transferring from emergency to normal.
6. All time delays shall be adjustable in 1 second increments.
7. All time delays shall be adjustable by using the display and keypad, with a remote device connected to the communications interface port or USB.
8. Each time delay shall be identified and a dynamic countdown shall be shown on the display. Active time delays can be viewed with a remote device connected to the communications interface port or USB.

D Additional Features

1. The controller shall have 3 levels of security. Level 1 shall allow monitoring of settings and parameters only. The Level 1 shall be capable of restricted with the use of a lockable cover. Level 2 shall allow test functions to be performed and Level 3 shall allow setting of all parameters.
2. The display shall provide for the test functions, allowed through password security. The test function shall be load, no load or auto test. The auto test function shall request an elapsed time for test. At the completion of this time delay the test shall be automatically ended and a retransfer sequence shall commence. All loaded tests shall be immediately ended and retransfer shall occur if the emergency source fails and the normal source is acceptable.
3. A contact closure shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
4. Auxiliary contacts shall be provided consisting of a minimum of two contacts, closed when the ATS is connected to the normal source and two contacts closed, when the ATS is connected to the emergency source.
5. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
6. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency sources (red), as determined by the voltage, frequency and phase rotation sensing trip and reset settings for each source.
7. A membrane switch shall be provided on the membrane panel to test all indicating lights and display when pressed.
8. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
9. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which closes to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad, communications interface port or USB. A "not-in-auto" LED shall indicate anytime the controller is inhibiting transfer from occurring.
10. An in-phase monitor shall be a standard feature in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for

- and be the product of the ATS manufacturer. The in-phase monitor shall be capable of being enabled or disabled from the user interface, communications interface port or USB.
11. A time based load control feature shall be available to allow the prioritized addition and removal of loads based during transfer. This feature may be enabled for either or both sources. The user shall be able to control up to nine loads with independent timing sequences for pre and post transfer delays in either direction of transfer.
 12. The controller shall provide 2 inputs for external controls that can be programmed from the following values:
 - a Common fault, Remote test, Inhibit transfer, Low battery voltage, Peak shave, Time delay bypass, Load shed forced to OFF position (Programmed transition only)
 13. The controller shall provide two form "C" contact outputs rated for up to 12A @ 240VAC or 2A @ 480VAC that can be programmed from the following values:
 - a Aux switch open, Transfer switch aux contact fault, Alarm silenced, Alarm active, I/O communication loss, Contactor position, Exercise active, Test mode active, Fail to transfer, Fail to acquire standby source, Source available, Phase rotation error, Not in automatic mode, Common alarm, In phase monitor sync, Load bank control active, Load control active, Maintenance mode active, Non-emergency transfer, Fail to open/close, Loss of phase, Over/under voltage, Over/under frequency, Voltage unbalance, Start signal, Peak shave active, Preferred source supplying load, Standby source supplying load
 14. The controller shall be capable of expanding the number of inputs and outputs with additional modules.
 15. Optional input/output modules shall be furnished which mount on the inside of the enclosure to facilitate ease of connections.
 16. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to 21 different exercise routines based on a calendar mode. For each routine, the user shall be able to:
 - a Enable or disable the routine
 - b Enable or disable transfer of the load during routine.
 - c Set the start time, time of day, day of week, week of month (1st, 2nd, 3rd, 4th, alternate or every)
 - d Set the duration of the run.
 - e At the end of the specified loaded exercise duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All loaded exercises shall be immediately ended and retransfer shall occur if the standby source fails. The next exercise period shall be displayed on the main screen with the type of exercise, time and date. The type of exercise and the time remaining shall be display when the exercise is active. It shall be possible of ending the exercise event with a single button push.
 17. Date and time - The date shall automatically adjust for leap year and the time shall have the capability of automatically adjusting for daylight saving and standard times.
 18. System Status - The controller shall have a default display the following on:
 - a System status
 - b Date, time and type of the next exercise event
 - c Average voltage of the preferred and standby sources
 - d Scrolling through the displays shall indicate the following:
 - i) Line to line and line to neutral voltages for both sources
 - ii) Frequency of each source
 - iii) Load current for each phase
 - iv) Single or three phase operation
 - v) Type of transition
 - vi) Preferred source
 - vii) Commit or no commit modes of operation
 - viii) Source/source mode
 - ix) In phase monitor enable/disable
 - x) Phase rotation

- xi) Date and time
- 19. Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.
- 20. Self-Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- 21. Communications Interface - The controller shall be capable of interfacing, through a standard communications with a network of transfer switches and generators. It shall be able to be connected via an RS-485 serial communication (up to 4000 ft. direct connect or multi-drop configuration). This module shall allow for seamless integration of existing or new communication transfer devices and generators.
- 22. The transfer switch shall also be able to interface to 3rd party applications using Modbus RTU open standard protocols utilizing Modbus register maps. Proprietary protocols shall not be acceptable.
- 23. The controller shall contain a USB port for use with a software diagnostic application available to factory authorized personnel for downloading the controller's parameters and settings; exercise event schedules; maintenance records and event history. The application can also adjust parameters on the controller.
- 24. Data Logging - The controller shall have the ability to log data and to maintain the last 2000 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory. The controller shall be able to display up to the last 99 events. The remaining events shall be accessible via the communications interface port or USB.
 - a Event Logging
 - i) Data, date and time indication of any event
 - b Statistical Data
 - i) Total number of transfers*
 - ii) Total number of fail to transfers*
 - iii) Total number of transfers due to preferred source failure*
 - iv) Total number of minutes of operation*
 - v) Total number of minutes in the standby source*
 - vi) Total number of minutes not in the preferred source*
 - vii) Normal to emergency transfer time
 - viii) Emergency to normal transfer time
 - ix) System start date
 - x) Last maintenance date
 - xi) * The statistical data shall be held in two registers. One register shall contain data since start up and the second register shall contain data from the last maintenance reset.
- 25. External DC Power Supply - An optional provision shall be available to connect up to two external 12/24 VDC power supply to allow the LCD and the door mounted control indicators to remain functional when both power sources are dead for extended periods of time. This module shall contain reverse battery connection indication and circuit protection.

2.3 Assembly or Fabrication

A Factory Assembly

2.4 Source Quality Control

A Test and Inspection

- 1. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the

specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

2. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.
- B Manufacturer's Services
C Coordination of Other Tests and Inspections

SECTION 26 32 13 ENGINE GENERATOR

PART 1 GENERAL

1.1 SUMMARY

- A This section includes the following items from a single supplier:
 - 1. Engine Generator Set.
 - 2. Enclosure
 - 3. Related Accessories as specified
- B Products Furnished or Supplied but not installed
- C Products Installed but not furnished or supplied
- D Related Requirements
 - 1. It is the intent of this specification to secure an engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein.
 - 2. Any exceptions to the published specifications shall be subject to the approval of the engineer and submitted minimum 10 days prior to the closing of the bid with a line by line summary description of all the items of compliance, any items that have been omitted or have been taken exception to, and a complete description of all deviations.
 - 3. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
 - 4. All equipment shall be new and of current production by an international, power system manufacturer of generators, transfer switches, and paralleling switchgear. The manufacturer shall be a supplier of a complete and coordinated system. There will be single-source responsibility for warranty, parts, and service through a factory-authorized representative with factory-trained technicians.

1.2 SUBMITTALS

- A Action Submittals
 - 1. Product Data
 - a The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.
 - 2. Shop Drawings
- B Informational Submittal
 - 1. Certificates
 - a The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.

2. Test and Evaluation Reports
 3. Manufacturer's Instruction
 4. Source Quality Control Submittals
 5. Field or Site Quality Control
- C Closeout Submittal
1. Maintenance Contracts
 2. Operation And Maintenance Data
 3. Bonds
 4. Warranty Documentation
 5. Record Documentation
 6. Software
- D Maintenance Material Submittals

1.3 QUALITY ASSURANCE

- A Regulatory Agency
1. The generator set shall conform to the requirements of the following codes and standards:
 - a CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - b EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
 - c EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - d IEC8528 part 4, Control Systems for Generator Sets.
 - e IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
 - f IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - g NFPA 70, National Electrical Code, Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - h NFPA 99, Essential Electrical Systems for Health Care Facilities.
 - i NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.
 2. Qualifications
 - a The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.
 - b The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
 3. Manufacturers
 - a The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system. The entire system shall be installed as shown on the plans, drawings, and specifications herein.
 4. Suppliers
 5. Fabricators
 6. Installers/ Applicators/ Erectors
 7. Testing Agencies
 8. Licensed Professional

- 9. Certificates
- 10. Preconstruction testing
- 11. Field and Site Samples

1.4 DELIVERY, STORAGE, AND HANDLING

- A Delivery and Acceptance Requirements
- B Storage and Handling Requirements
- C Packaging Waste Management

1.5 FIELD OR SITE CONDITIONS

- A Ambient Conditions
 - 1. Engine- generator set shall operate in the following conditions without any damage to the unit or its loads.
 - a Ambient Temperature: 95 °F
 - b Altitude : 30 ft
 - c Relative Humidity: 95%
- B Existing Conditions-Coastal environment.

PART 2 PRODUCTS

- 2.1. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
- 2.2. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, transfer switches, and switchgear, and assembles the generator sets as a complete and coordinated system. There will be one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

2.3 EQUIPMENT

- A Equipment
 - 1. The generator set shall be a Kohler model 350REZXB with a 5M4027 alternator. It shall provide 443.75 kVA and 355.00 kW when operating at 120/208 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130°C Standby rating while operating in an ambient condition of less than or equal to 95 °F and a maximum elevation of 30 ft above sea level. The standby rating shall be available for the duration of the outage.
- B Engine
 - 1. The minimum 18.3 liter displacement engine shall deliver a minimum of 530 HP at a governed engine speed of 1800 rpm, and shall be equipped with the following:
 - a. Electronic isochronous governor capable of 0.5% steady-state frequency regulation
 - b. 24-volt positive-engagement solenoid shift-starting motor
 - c. 45-ampere automatic battery charging alternator with a solid-state voltage regulation

- d. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain
- e. Dry-type replaceable air cleaner elements for normal applications
- f. The engine shall be turbocharged and fueled by Natural Gas
- g. The engine shall have a minimum of 10 cylinders and be liquid-cooled
2. The engine shall be EPA certified from the factory
3. The generator must accept rated load in one-step.

C Alternator

1. The alternator shall be salient-pole, brushless, 2/3-pitch, with 4 bus bar provision for external connections, self-ventilated, with drip-proof construction and amortisseur rotor windings, and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a vacuum pressure impregnated, fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to 130°C Standby. The PMG based excitation system shall be of brushless construction controlled by a digital, three phase sensing, solid- state, voltage regulator. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
2. The alternator shall have a maintenance-free bearing, designed for 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
3. The generator shall be inherently capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.
4. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying 1,164.00 LRKVA for starting motor loads with a maximum instantaneous voltage dip of 15%, as measured by a digital RMS transient recorder in accordance with IEEE Standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip, i.e., engine, alternator, voltage regulator, and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.

D Vibration Isolation

1. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

4. CONTROLLER

4.1. Decision-Maker® 550 Controller

4.1.1. The generator set controller shall meet NFPA 110 Level 1 requirements and shall include an integral alarm horn as required by NFPA.

4.1.2. The controller shall meet NFPA 99 and NEC requirements.

4.1.3. The controller shall be UL 508 listed.

4.2. Applicability

4.2.1. The controller shall be standard on a 350REZXB.

4.2.2. The controller shall support 24-volt starting systems.

4.2.3. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.

4.2.4. The controller shall mount on the generator or remotely within 40 feet with viewable access.

4.3. Hardware Requirements

4.3.1. Control Panel shall include:

1. The control shall have a run-off/reset-auto three-position selector switch.
2. A controller-mounted, latch-type emergency stop pushbutton.
3. Five indicating lights: System Ready - green Not in Auto - yellow Programming Mode - yellow System Warning - yellow System Shutdown - red
4. Display with two lines of 20-alphanumeric characters, viewable in all light conditions.
5. Sixteen position snap action sealed keypad for menu selection and data entry.
6. For ease of use, an operating guide shall be printed on the controller faceplate.
7. An audible alarm with alarm silence capability.
8. Panel lights shall be supplied as standard.

4.4. Control Functional Requirements

4.4.1. Field-programmable time delay for engine start. Adjustment range 0-5 minutes in 1 second increments.

4.4.2. Field-programmable time delay engine cooldown. Adjustment range 0-10 minutes in 1 second increments.

4.4.3. Capability to start and run at user-adjustable idle speed during warmup for a selectable time period (0-10 minutes), until engine reaches preprogrammed temperature, or as supported by ECM-equipped engine.

4.4.4. The idle function including engine cooldown at idle speed.

4.4.5. Real-time clock and calendar for time stamping of events.

4.4.6. Output with adjustable timer for an ether injection starting system. Adjustment range, 0-10 seconds.

4.4.7. Output for shedding of loads if the generator set reaches a user programmable percentage of its kW rating. Load shed shall also be enabled if the generator set output frequency falls below 59 Hz.

4.4.8. Programmable cyclic cranking that allows up to six crank cycles and up to 35 seconds of crank time per crank cycle.

4.4.9. The capability to reduce controller current battery draw, for applications where no continuous battery

charging is available. The controller vacuum fluorescent display should turn off automatically after the controller is inactive for 5 minutes.

- 4.4.10. Control logic with alternator protection for overload and short circuit matched to each individual alternator and duty cycle.
- 4.4.11. Control logic with RMS digital voltage regulation. A separate voltage regulator is not acceptable. The digital voltage regulator shall be applicable to single- or three-phase systems.
- 4.4.12. The capability to exercise the generator set by programming a running time into the controller. This feature shall also be programmable through the PC software.
- 4.4.13. Control function shall include output voltage adjustment.
- 4.4.14. Battle switch function selection to override normal fault shutdowns, except emergency stop and overspeed shutdown.
- 4.4.15. The control shall detect the following conditions and display on control panel:

1. Customer programmed digital auxiliary input ON (any of the 21 inputs available)
2. Customer programmed analog auxiliary input out of bounds (any of 7 inputs for ECM equipped engines and 5 inputs for non ECM engines)
3. Emergency stop
4. High coolant temperature
5. High oil temperature
6. Controller internal fault
7. Locked rotor - fail to rotate
8. Low coolant level
9. Low oil pressure
10. Master switch error
11. NFPA common alarm
12. Overcrank
13. Overspeed with user-adjustable level, range 60-70 Hz.
14. Overvoltage with user adjustable level, range 105% to 135%
15. Overfrequency with user adjustable level, range 102% to 140%
16. Underfrequency with user adjustable level, range 80% to 90%
17. Undervoltage with user adjustable level, range 70% to 95%
18. Coolant temperature signal loss
19. Oil pressure gauge signal loss

Conditions resulting in generator warning (generator will continue to operate):

1. Battery charger failure
2. Customer programmed digital auxiliary input on (any of the 21 inputs available)
3. Customer programmed analog auxiliary input on (any of the 7 inputs available on ECM engines and 5 inputs for non ECM engines)
4. Power system supplying load
5. Ground fault detected - detection by others

6. High battery voltage - Level shall be user adjustable.
7. Range 29-33 volts for 24-volt systems.
8. High coolant temperature
9. Load shed
10. Loss of AC sensing
11. Underfrequency
12. Low battery voltage - level shall be user adjustable, range 20-25 volts for 24-volt systems.
13. Low coolant temperature
14. Low fuel level or pressure
15. Low oil pressure
16. NFPA common alarms
17. Overcurrent
18. Speed sensor fault
19. Weak battery
20. Alternator protection activated

4.5. Control Monitoring Requirements

4.5.1. All monitored functions must be viewable on the control panel display.

4.5.2. The following generator set functions shall be monitored:

1. All output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy
2. All single phase and three phase currents, 0.25% accuracy
3. Output frequency, 0.25% accuracy
4. Power factor by phase with leading/lagging indication
5. Total instantaneous kilowatt loading and kilowatts per phase, 0.5% accuracy
6. kVARS total and per phase, 0.5% accuracy
7. kVA total and per phase, 0.5% accuracy
8. kW hours
9. A display of percent generator set duty level (actual kW loading divided by the kW rating)

4.5.3. Engine parameters listed below shall be monitored: (*available with ECM equipped engines)

1. Coolant temperature both in English and metric units
2. Oil pressure in English and metric units
3. Battery voltage
4. RPM
5. Lube oil temperature*
6. Lube oil level*
7. Crankcase pressure*
8. Coolant level*
9. Coolant pressure*
10. Fuel pressure*
11. Fuel temperature*
12. Fuel rate*
13. Fuel used during the last run*

14. Ambient temperature*

4.5.4. Operational records shall be stored in the control beginning at system startup.

1. Run time hours
2. Run time loaded hours
3. Run time unloaded hours
4. Number of starts
5. Factory test date
6. Last run data including date, duration, and whether loaded or unloaded
7. Run time kilowatt hours

4.5.5. The following operational records shall be a resettable for maintenance purposes:

1. Run time hours
2. Run time loaded hours
3. Run time unloaded hours
4. Run time kilowatt hours
5. Days of operation
6. Number of starts
7. Start date after reset

4.5.6. The controller shall store the last one hundred generator set system events with date and time of the event.

4.5.7. For maintenance and service purposes, the controller shall store and display on demand the following information:

1. Manufacturer's model and serial number
2. Battery voltage
3. Generator set kilowatt rating
4. Rated current
5. System voltage
6. System frequency
7. Number of phases

4.6. Inputs and Outputs

4.6.1. Inputs

1. There shall be 21 dry contact inputs that can be user-configured to shut down the generator set or provide a warning.
2. There shall be 7 user-programmable analog inputs for ECM-equipped engines (5 for non-ECM engines) for monitoring and control.
3. Each analog input can accept 0-5 volt analog signals
4. Resolution shall be 1:10,000
5. Each input shall include range settings for 2 warnings and 2 shutdowns.
6. All values shall be on the control panel display.
7. Shall be user-assigned.
8. Additional standard inputs required:

- Input for an external ground fault detector. Digital display shall show "ground fault" upon detection of a ground fault.
 - Reset of system faults.
 - Remote two-wire start.
 - Remote emergency stop.
9. Idle mode enable.

4.6.2. Outputs

1. All NFPA 110 Level 1 outputs shall be available.
2. Thirty outputs shall be available for interfacing to other equipment:
 - All outputs shall be user-configurable from a list of 25 functions and faults.
 - These outputs shall drive optional dry contacts.
3. A programmable user-defined common fault output with over 40 selections shall be available.

4.7. Communications

- 4.7.1. If the generator set engine is equipped with an ECM (engine control module), the controller shall communicate with the ECM for control, monitoring, diagnosis, and meet SAE J1939 standards.
- 4.7.2. Industry standard Modbus communication shall be available.
- 4.7.3. A Modbus master shall be able to monitor and alter parameters, and start or stop a generator.
- 4.7.4. The controller shall have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT.
- 4.7.5. Communications shall be available for serial, CAN, and Ethernet bus networks.
- 4.7.6. A variety of connections shall be available based on requirements:
1. A single control connection to a PC.
 2. Multiple controls on an intranet network connected to a PC.
 3. A single control connection to a PC via phone line.
 4. Multiple controls to a PC via phone line.
- 4.7.7. Generator and transfer switch controls shall be equipped with communications modules capable of connecting to the same communication network.
- 4.7.8. The capability to connect up to 128 controls (any combination of generator sets and transfer switches) on a single network shall be supported.
- 4.7.9. Cabling shall not be limited to the controller location.
- 4.7.10. Network shall be self-powered.

5. Accessories

- 5.1. **Air Restriction Indicator.** The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.
- 5.2. **Battery Charger.** A 45-ampere automatic float to equalize battery charger with the following features:
1. 12 or 24 VDC output
 2. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations
 3. Ammeter and voltmeter with 5% full-scale accuracy
 4. LED lamp for power indication
 5. Current limited during engine cranking, short circuit, and reverse polarity conditions
 6. Temperature compensated for ambient temperatures for -40°C to 60°C
 7. UL Listed
- 5.3. **Battery Rack and Cables.** Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- 5.4. **Circuit Breakers.** The generator shall come with a primary, factory installed, 100% rated line circuit breaker of 600, 125, & 400 amperes that is UL2200 listed. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, undervoltage trip, alarm switch, and overcurrent switch functionality. Load side breaker connections made at the factory shall be separated from field connections. When GFI breakers are required, additional neutrals shall be factory installed.
- 5.5. **Remote Annunciator Panel.** The remote annunciator shall meet NFPA 110, Level 1 requirements and enable remote viewing of the generator status. The panel shall be connected to the generator controller via either network communication wires or via hard wired connections. Options shall be available to provide ATS source availability, contactor position, and loaded or unloaded test for up to four transfer switches. The panel shall have the capability to be either flush-mounted or surface-mounted and be installed in the Fire Command Room. The annunciator shall meet UL508 requirements.
- 5.7. **Standard Air Cleaner.** The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.
- 5.8. **Block Heater.** The block heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.

6. Sound Enclosure

- 6.1. The enclosure shall be wind load rated and constructed from high strength aluminum and be provided with stainless steel hardware and hinges.
- 6.2. The enclosure shall be finish coated with powder baked paint for superior finish, durability and appearance. Enclosures will be finished in the manufacturer's standard color.
- 6.3. The enclosure shall allow the generator set to operate at full load in an ambient of 40°C - 45°C with no additional derating of the electrical output.
- 6.4. The enclosure shall be equipped with sufficient side and end doors to allow access for operation, inspection,

and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.

- 6.5. Doors shall be equipped with lockable latches. Locks must be keyed alike.
- 6.6. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.
- 6.7. The complete exhaust system shall be internal to the enclosure.
- 6.8. All acoustical insulation shall be fixed to the mounting surface with pressure sensitive adhesive or mechanically fastened. In addition, all acoustical insulation mounted on a horizontal plane shall be mechanically fastened. The acoustical insulation shall be flame retardant.
- 6.9. The enclosure shall include an exhaust scoop to direct the cooling air in a vertical direction.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which emergency generator is to be installed, and substrate for supporting emergency generator. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF EMERGENCY GENERATOR:

- A. Install emergency generator at location as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that emergency generator fulfill requirements.
- B. Coordinate with other electrical work as appropriate to properly interface installation of emergency generator with other work.
- C. Tighten connectors and terminals, including screws and bolts, to comply with tightening torques specified in UL Stds 486A and B.

3.3 ADJUSTING AND CLEANING:

- A. Clean emergency generator of dirt and debris upon completion of installation.
- B. Protect installed emergency generator from damage during remainder of construction period.

3.4 FIELD QUALITY CONTROL:

- A. Upon completion of installation of emergency generator and all start-up procedures and after building circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance.
- B. For a period of one year following the Date of Substantial Completion, provide Routine Maintenance and Operational Testing IAW NFPA 110, Chapter 8 together with a proposal for identical maintenance and operational testing for subsequent years.

3.5 GROUNDING:

- A. Provide equipment grounding connections for emergency generator as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

END OF SECTION 263213

SECTION 26 43 13 - SURGE SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Conditions sections, apply to the work of this section.

1.2 DESCRIPTION:

- A. General: The term surge protective device (SPD) describes the equipment necessary for the protection of all AC electrical circuits and equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.3 REFERENCE STANDARDS AND PUBLICATIONS:

- A. ANSI/IEEE C62.41 (IEEE 587) Guide for Surge Voltages in Low-Voltage AC Power Circuits Categories A, B and C.
- B. ANSI/IEEE C62.33 Standard for Test Specifications for Varistor Surge Protection Devices.
- C. ASI/IEEE C62.45 Guide on Surge Testing for Equipment Connected Low Voltage AC Power Circuits.
- D. IEEE Standard 142-Recommended Practice for Grounding.
- E. IEEE Standard 518 Recommended Guide on Electrical Noise.
- F. UL-1449 3rd Edition: Standard for Surge Protective Devices.
- G. UL-1283 for EMI Filters.
- H. NFPA 70, 75 and 78 (780).
- I. MIL Std. 220A
- J. FIPS PUB 94.
- K. CCITT Rec. K-17 Waveform specification for electronic systems

1.4 SYSTEM PERFORMANCE CRITERIA:

- A. General: Surge suppression, grounding and bonding required by this specification for protection of electrical systems shall effectively protect the systems to which it is applied against lightning, equipment transients, internal spikes, and other surge transients throughout the useful life of the system. Surge suppression devices and related grounding and bonding systems shall be designed and installed in such a manner that normal operation and listing of the system is not impaired due to the installation of such devices.

- B. Intent: The intent of this specification is to allow manufacturers with varying equipment concepts to provide transient voltage surge suppression, which will properly protect equipment within the guidelines, set forth herein. Specific manufacturers listed shall be used as the basis of design, however, submitted components shall comply with the minimum and maximum values listed and shall be equal to or better than the specific manufacturer's type specified herein. The listed data specified herein shall be used for the comparative analysis of all manufacturers.

1.5 MANUFACTURER QUALIFICATIONS:

- A. General: All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of SPD units for electrical and electronic systems equipment for a period of (5) years.
- B. Repair: The surge suppressor manufacturer shall offer factory repair service and replacement for all units. The manufacturer shall provide this service within four working days, and provide replacement components shipped to the Owner for installation within the allocated response time.
- C. Acceptable Manufacturers: Only the following acceptable manufacturers shall be considered:
 - 1. Advanced Protection Technologies,
 - 2. Leviton (Approved for receptacle-type SPD),
 - 3. PQ Protection, Surge Suppression, Inc.

1.6 WARRANTY:

- A. Period: All surge suppression devices and supporting components shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of five years from the date of substantial completion or service activation for the system to which the suppressor is attached. The contractor shall submit a check-out memo to the manufacturer indicating the date when the equipment was put into service and the actual method of installation. Submit three copies to the Engineer for review.
- B. Replacement: Any suppressor, which shows evidence of failure or incorrect operation during the warranty period, shall be repaired or replaced at no expense to the Owner. Since "Acts of Nature" or similar statements include the lightning threat to which these suppression devices shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. The warranty shall cover the entire device not just the modules.

1.7 SUBMITTAL:

- A. Product Data: Submit manufacturer's data on all surge protective devices.
- B. General: Surge suppression devices shall be submitted as an integral part of the equipment submittal for the system or equipment, which they protect. Surge suppressors and their wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system.
- C. Testing: The test data submitted shall be specific for the actual method of installation proposed. Submittals will not be reviewed unless they include proper project related data. Interpretation of standard manufacturers published data will not be acceptable unless the data coincides with the actual installation procedure.

- D. Information: The surge suppression submittal shall also include, but shall not be limited to, the following additional data:
1. Complete data for each suppressor type indicating conductor sizes, conductor types, connection configuration, lead lengths and all appropriate dimensions.
 2. Dimensions for each suppressor type indicating mounting dimensions and required accessory hardware.
 3. Manufacturers certified test data indicating the ability of the product to meet or exceed requirements of this specification.
 4. If requested, a sample of each suppressor type to be used for testing and evaluation shall be submitted.
 5. Drawings shall be provided indicating surge protection device mounting arrangement and lead length configuration.
 6. List and detail all protection systems such as fuses.

PART 2 - PRODUCTS

2.1 PERFORMANCE:

- A. The surge suppression equipment shall perform as follows:

LOCATION:	MINIMUM SURGE CURRENT/PHASE	CAT.	SYSTEM MAXIMUM RESPONSE TIME IN NANOSECS	COMPONENT MAXIMUM RESPONSE TIME IN NANOSECS	MINIMUM COMMON & NORMAL MODE NOISE REJECTION IN DB.
Service Entrance	300,000 A	C3	5	1	40
Distribution Equipment (400A or Larger)	225,000 A	B3	5	1	40
Panelboards (Less than 440A)	150,000 A	B3	5	1	40
Receptacle Devices	6,000 A	A	5	1	40

- B. Voltage Ratings: Voltage ratings shall be as follows:
1. 120, 120/208 OR 120/240 V. systems
- C. Clamping Voltage: Clamping voltage ratings shall be 7 modes for main device and 7 modes for branch distribution and panelboard locations. The following shall be used for maximum clamping voltage values allowed.
- D. Insertion Loss: Standardized insertion loss data shall be obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology. Minimum insertion loss shall be as follows:

Frequency:	Insertion Loss (dB):
100Khz	34
1MHZ	51

10MHZ	54
100MHZ	48

- E. Unit Operating Voltage: The nominal unit operating voltage and configuration shall be as shown on the contract documents. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% at 120V, and 115% and 220, 240 volts.
- F. Power Interruption: During normal suppression operation, the unit shall not short circuit or crowbar the power flow that would result in an interruption to the load. Building power shall not require interruption for maintenance.
- G. Visual and Audible Indication: Visual and audible indication on the cover of the enclosures shall indicate proper system operation. Visual indication shall also indicate mode failure. The audible alarm shall have a silencing switch. Audible alarm shall be applicable for the main device only.

2.2 BONDING AND GROUNDING CONDUCTORS AND MATERIALS:

- A. Size: Conductors utilized for surge suppressor bonding shall be a minimum of #6 AWG solid insulated copper unless otherwise specified.
- B. Bus: Ground bus or strip material shall be copper, a minimum of 26 gauge in thickness and three inches wide unless otherwise specified. Bus materials may be secured to surfaces with an appropriate mastic material or mechanical fasteners. Bus connections shall be bolted and reinforced as necessary to provide a permanent and secure connection.
- C. Rods: Unless otherwise specified, all surge suppression grounding electrodes, where provided, shall be 5/8" diameter copper weld rods, twenty feet in length.
- D. Connections Compliance: Connectors, splices, and other fittings used to interconnect grounding conductors, bonding to equipment or ground bars, shall comply with requirements of the National Electric Code and be accepted by Underwriters Laboratories for the purpose.
- E. Connectors: Connectors and fittings for grounding and bonding conductors shall be of the compression type in above grade locations. Connections below grade shall be exothermically welded or brazed.
- F. Dissimilar Materials: Bonding connections between electrically dissimilar metals shall be made using exothermic welds or using bi-metal connectors designed to prevent galvanic corrosion.
- G. Separate Transient Ground Path: SPD units shall have a transient ground path connection and conductor for the purpose of carrying transient energy directly to ground via building steel or direct ground rod connection. This connection shall be separate from the safety ground.

PART 3 - EXECUTION

3.1 SEGREGATION OF WIRING:

- A. General: All system wiring shall be classified into protected and non-protected categories. Wiring on all exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.

- B. Protection: All wiring between surge suppressors and protected equipment shall be considered protected and connected in accordance with the latest edition of the NEC.
- C. Separation: A minimum of three inches of separation shall be provided between parallel runs and protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.

3.2 INSTALLATION OF SUPPRESSORS:

- A. General: Suppressors shall be installed as close as practical to the equipment to be protected consistent with the available space, however, do not exceed three feet. Where installation space permits and where no code restrictions apply, suppressors may be installed within the same cabinet as the protected equipment. Suppressors installed in this manner shall utilize the equipment chassis as a medium for bonding of their ground terminals. Bonding jumpers not exceeding two inches in length shall be installed between the chassis and suppressor ground terminals. Bolted connections with star washers shall be used to insure electrical and mechanical integrity of connections to the equipment chassis. Suppressors shall be closely nipped to the device being protected in a position near the neutral bus, which will minimize lead length between suppressors and the buses and disconnect means to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the Engineer.
- B. Suppressor Locations: Surge suppression equipment described herein and indicated on the contract drawings shall installed in the following locations:
 - 1. At the electrical service entrance and all distribution panels.
 - 2. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment.
- C. Disconnect: The main service entrance device shall be provided with an integral disconnect switch with fuses. The disconnect switch shall be fused with current limiting fuses. Switches must have a fault withstand AIC rating equal to or greater than the power distribution equipment being protected.
- D. Workmanship: Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.
- E. Bonding: Bonding between ground terminals for power and signal line suppressors serving a particular item or cluster of equipment shall be kept as short as possible. Where practical, suppressors, shall be installed in a common location for the cluster with their ground terminals bonded closely together. For installations requiring separation between the various suppressor grounds and equipment chassis within an equipment cluster, the following table shall be used to determine bonding conductor requirements (distances are measured between most distant suppressor or chassis grounds).

<u>BONDING DISTANCE</u>	<u>MATERIAL</u>
0 - 10 feet	#6 AWG Bare Copper (Solid)
10 - 25 feet	1 - 1/2" Copper Strip 26ga. min.
25 - 50 feet	3" Copper Strip 26ga. min
Over 50 feet	6" Copper Strip 26ga. min.

- F. Care shall be exercised to avoid connection of incidental grounds to the bonding bus system.
- G. Ground Plane: Where terminal cabinets are used to house surge suppressors, painted steel backboards shall be used to serve as a low impedance ground plane for bonding surge suppressor leads together. Terminal boards used for the same purpose shall be laminated with a single sheet of 14 ga. galvanized steel to serve as a ground plane for suppressors. Suppressors with ground terminals not inherently bonded to the ground plane through their mounting shall be bonded to this plane using a two-inch maximum length of #12AWG copper wire and suitable lug. Ground planes and backboards shall be drilled to accept self-tapping screws, any paint in the area of the bond shall be removed and star washers shall be used.
- H. Interconnection: Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG bare copper conductor and accepted connections unless otherwise noted.

END OF SECTION 26 43 13

SECTION 26 51 00 - INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Types of interior lighting fixtures in this section include the following:
 - 1. Light-emitting diode (LED)
- B. Applications of interior lighting fixtures required for project include the following:
 - 1. General lighting.

1.3 QUALITY ASSURANCE:

- A. NEC Compliance: Comply with NEC as applicable to installation and construction of interior building lighting fixtures.
- B. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No's. LE 1 and LE 2 pertaining to lighting equipment.
- C. IES Compliance: Comply with Illuminating Engineering Society of North America (IESNA) 9th Edition, regarding selection of illuminance values for interior space lighting.
- D. UL Compliance: Comply with UL standards, including Stds 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components, which are UL-listed and labeled.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data on interior building lighting fixtures.
- B. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, (Table of Contents summarizing catalog numbers required), with proposed fixture and accessories clearly indicated on each sheet.
- C. Maintenance Data: Submit maintenance data and parts list for each interior lighting fixture and accessory; including "troubleshooting" maintenance guide. Include that data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 INTERIOR LIGHTING FIXTURES:

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with (where applicable), but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship fixtures factory-assembled, with parts required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated sounds.
- B. All metal parts shall be cleaned and pretreated with minimum five-stage phosphate process after fabrication and prior to painting. All metal parts of fixtures shall be painted after fabrication. (Pre-painted steel is not acceptable.) Paint reflectance shall not be less than 89%.
- C. Troffer reflector shall be finished with a high reflective matte white powder paint for improved aesthetics and increased light diffusion. End plates contain easy-to-position integral or screw on T-bar clips for securely attaching the luminaire to the T-grid. Diffusers shall be extruded from impact modified acrylic for increased durability.
- D. LED boards are accessible from below; driver is accessible from the plenum.
- E. Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring as follows:
 - 1. NEC Type AF for 120 volt, minimum No. 18 AWG.
 - 2. NEC Type SF-2 for 277 volt, minimum No. 18 AWG.
- F. Interior Lighting Fixture Types:
 - 1. General: Various fixture types required are indicated on drawings. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, and suspension systems appropriate to installation.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF INTERIOR LIGHTING FIXTURES:

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Coordinate with other electrical work as appropriate to properly interface installation of interior lighting fixtures with other work.
- C. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Architect/Engineer.

- D. Install flush mounted fixtures to eliminate light leakage between fixture frame and finished surface.
- E. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling. Where applicable, end panels of modular coffered ceiling fixtures shall be provided and installed by Electrical Contractor.
- F. Fasten fixtures securely to structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2' with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum 1" vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger than number of fixtures in the row.
- G. Tighten connectors and terminals, including screws and bolts, to comply with tightening torques specified in UL Stds 486A and B.
- H. Support surface mounted fixtures greater than 2' in length at a point in addition to the outlet box fixture stud.

3.3 ADJUSTING AND CLEANING:

- A. Clean interior lighting fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.

3.4 FIELD QUALITY CONTROL:

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.
- C. At Date of Substantial Completion, replace lamps in interior lighting fixtures, which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect/ Engineer.
- D. Refer to General and Supplementary General Conditions sections for the replacement/restoration of lamps in interior lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.

3.5 GROUNDING:

- A. Provide equipment grounding connections for interior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Special Conditions sections, apply to work of this section.
- B. Division-26 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY:

- A. Extent of exterior lighting fixture work is indicated by drawings and schedules.
- B. Types of exterior lighting fixtures in this section include the following:
 - 1. Light-emitting diode (LED).
- C. Applications of exterior lighting fixtures required for this project include the following:
 - 1. Outdoor area lighting.
 - 2. Outdoor security lighting.
- D. Poles and standards if required for use in conjunction with exterior lighting fixtures shall be per the fixture schedule or approved equivalent.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data and installation instructions on each type exterior building lighting fixture, pole and components.
- B. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.
- C. Wiring Diagrams: Submit wiring diagrams for exterior lighting fixtures showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring, which are manufacturer-installed, and portions, which are field-installed.
- D. Illumination Data: Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows composite values of illuminance projected from the arrangement of light sources from indicated fixture locations and heights. Show on the graphic plots the locations, spacings and heights of luminaires.

1.4 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of exterior building lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with exterior lighting fixture work similar to that required for project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 225, 250, 410, and 501 as applicable to installation, and construction of exterior building lighting fixtures.
2. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No. LE 2 pertaining lighting equipment.
3. IES Compliance: Comply with IES RP-8, 19, 20 and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.
4. UL Compliance: Comply with requirements of UL standards, including Stds 486A and B, pertaining to exterior lighting fixtures. Provide exterior lighting fixtures and components, which are UL-listed and labeled.
5. NFPA Compliance: Comply with applicable requirements of NFPA 78, "Lightning Protection Code," pertaining to installation of exterior lighting fixtures.
6. CBM Labels: Provide fluorescent lamp ballasts, which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver exterior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from construction debris and physical damage.
- B. Store exterior lighting fixtures in original wrappings in a clean dry place. Protect from weather, dirt, fumes, water, construction debris, and damage.
- C. Handle exterior lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from site and replace with new.

1.6 SEQUENCING AND SCHEDULING:

- A. Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of exterior lighting fixtures with other work.
- B. Sequence exterior lighting installation with other work to reduce possibility of damage and soiling of fixtures during remainder of construction period.

1.7 MAINTENANCE:

- A. Maintenance Data: Submit maintenance data and parts list for each exterior lighting fixture and accessory; including "trouble- shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Provide fixtures as listed in the fixture schedule.

- B. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy efficient ballasts, starters and wiring.
- C. Wiring: Provide electrical wiring within fixtures, which are suitable for connection to branch circuit wiring as follows:
 - 1. NEC Type AF for 120-volts, minimum No. 18 AWG.
 - 2. NEC Type SF-2 for 277-volts, minimum No. 18 AWG.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine areas and conditions under which lighting fixtures are to be installed, and substrate, which will support lighting fixtures. Notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF EXTERIOR LIGHTING FIXTURES:

- A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.
- C. Fasten electrical lighting fixtures and brackets securely to indicated structural supports, including poles/standards; and ensure that installed fixtures are plum and level.

3.3 GROUNDING:

- A. Provide equipment grounding connections for exterior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.4 FIELD QUALITY CONTROL:

- A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.
- B. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures, which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect.
- C. Refer to Division-1 sections for the replacement/restoration of lamps in exterior lighting fixtures, where used for temporary lighting prior to Date of Substantial Completion.

3.5 ADJUSTING AND CLEANING:

- A. Aim adjustable lighting fixtures and lamps in night test of system. Verify that measured illuminance values comply with isolux plot diagram values.
 - B. Clean lighting fixtures of dirt and debris upon completion of installation.
 - C. Protect installed fixtures from damage during construction period.
- 3.6 DEMONSTRATION:
- A. Upon completion of installation of exterior lighting fixtures, and associated electrical supply circuitry, apply electrical energy to circuitry to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 26 56 00

SECTION 281500.30 – MULTI-FAMILY DATA-ON-CREDENTIAL ACCESS CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. System operation and credential encoding system.
2. Online door controller system.
3. Mobile configuration application.
4. Electromechanical resident room locks.
5. Electromechanical common area locks.
6. Credential enrollment station.
7. Cloud based access control system application software.
8. Access credentials.

- B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 01 Section "Closeout Procedures".
3. Division 08 Section "Door Hardware Schedule".
4. Division 08 Section "Automatic Entrances".
5. Division 08 Section "Door Hardware".
6. Division 11 Section "Parking Control Equipment".
7. Division 14 Section "Elevators".
8. Division 26 Section "Electrical".
9. Division 28 Section "Access Control Hardware".

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 80 - Fire Doors and Windows.
4. NFPA 101 - Life Safety Code.
5. NFPA 105 - Installation of Smoke Door Assemblies.

6. FCC Part 15 Subpart C.
7. State Building Codes, Local Amendments.

- D. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series
 2. UL10C – Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. System Operational Descriptions: Complete system operational narratives for the integrated access controlled openings defining the owner's prescribed requirements for the opening functionality. Narratives include, but are not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary access control components.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware and site management installation in quantity as required in Division 01, Closeout Submittals. The manual to

include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory components upon receipt and provide secure lock-up and shelving. Do not store electronic locks, software or accessories at Project site without prior authorization.
- B. Tag each lockset or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service.

1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing electrified door hardware and access control system components.
- B. System Survey: Prior to ordering the system, review the construction documents to determine the correct number and locations of stand-alone locks and wired devices if possible.
 - 1. Data-on-Credential applications that require physical credentials are supported by online updaters.
- C. Electrical Connections: Coordinate the layout and installation of scheduled electrified door and related access control equipment with required connections to source power junction boxes, low voltage power supplies and Power over Ethernet switches as applicable.

1.6 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run

concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. nexTouch NTB600 Series Cylindrical Lock: 3 year electrical, 3 year mechanical, 1 year finish.
 - 2. nexTouch NTM600 Series Mortise Lock: 3 year electrical, 3 year mechanical, 1 year finish.
 - 3. nexTouch NTT600 Series Electrified Trim for Rim Exit Device: 3 year electrical, 3 year mechanical, 1 year finish.
 - 4. YRL YRD600 Series Deadbolt Lock: 1 year electrical, 3 year mechanical, 1 year finish.
 - 5. YRL YRC600 Series Interconnected Lock: 1 year electrical, 3 year mechanical, 1 year finish.
 - 6. Yale NTX-600-KIT Updater/Controller: 1 year electrical.
 - a. NTX600-CTRL: 1 year electrical.
 - b. HID R10BLE, R40BLE, SE SEOS BLE Readers: limited lifetime electrical.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed by certified integrator for continued adjustment, maintenance, and removal and replacement of system components.

1.8 SCOPE OF WORK

- A. Access Control Site Management System: Furnish and install at the indicated locations the specified integrated access control door hardware and access control system firmware and software for a completely operational access control. System includes, but is not necessarily limited, to the following:

1. Electrified integrated access control locks, network switches, updaters, door position switches, remote credential updaters, keypads, access credentials, system application software and mobile configuration device application, special tools, operating manuals, and required cabling and accessories as detailed below and listed in the Access Control Hardware Sets at the end of Part 3.
 - a. Provide manufacturer approved integrated access control locks, exit hardware, and remote mounted credential updaters and keypads that are functionally compatible with the specified access control equipment interfaces.

B. Owner to provide the following:

1. Internet accessible devices that support current browser software.
2. Compatible mobile devices that run an Android OS and offer NFC (Near Field Communication) capabilities, thus capable of accepting the mobile configuration application.
 - a. For offline lock and online updater configuration: Mobile device to run an Android OS and offer NFC (Near Field Communication) capabilities, thus capable of accepting the mobile configuration application.
 - b. For mobile access to offline lock and online updaters: Bluetooth Low Energy (BLE) capable IOS or Android mobile device with internet connection to download the Yale Accentra Access mobile application
3. Power Sourcing, Network Switches, Power over Ethernet: Quantity as required to accommodate installed access control devices.
4. Network Control Connections: LAN/Ethernet communication ports (jacks) and network interface cards as needed, CAT5e (CAT6) cabling from network router/switch to networked updater, outlet and cover plates and/or patch cables required for network connection.
5. Power Supplies, including battery or uninterrupted backup power supply (UPS) and separately fused surge protection, required for the electrified door hardware, access control equipment, and PoE switches or wireless routers driving the integrated credential reader locking devices.
6. Installation, final configuration and commissioning of electrified door and access control system hardware, power supplies and related accessories.
7. System application and cloud services and mobile application including installation, programming, and end user training of the access control system and mobile access applications demonstrating operating, repair, and maintenance procedures.

C. Electrical contractor, Division 26, to provide the following:

1. Source power wiring (120VAC) as required for the integrated locking and access control hardware, equipment, accessories and power supplies. This includes quad outlets as required on a dedicated circuit and the related conduit, stub-in, junction boxes and connectors required for the source power delivery and connections.
2. Provide required conduit, stub-in, junction and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per plan drawings and specs. Supply and install conduit between each of the aforementioned devices and between the electrical junction boxes, power supplies and access control equipment located on or above the door opening.
 - a. At wall mounted updaters, provide conduit on the secured side of the door, 36" from the finish floor and 6" from the edge of the frame, to the related power supplies and access control equipment.
 - b. At electrical hardware power transfers provide conduit on the secured side of the opening from the power transfer, thru-wire hinge, or serviceable panel location on the frame jamb to the related power supplies and access control equipment.
3. Electrical Contractor to provide all 120VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

D. Access Control System Integrator to provide the following:

1. Low voltage wiring (12/24VDC) and communication cabling (RS-485) to support controllers, relays, and electrified locking devices and door operators to updaters and power supplies. Work includes related connectors, final terminations, and hook-ups required for a complete and functional access controlled opening in accordance with applicable codes and specified system operational narratives.
 - a. Provide size appropriate spacers for updaters mounted against metal surfaces.

E. Elevator Contractor to provide the following:

1. Interface or landing of interface cable onto the elevator call button will be performed by a certified elevator contractor.
2. Coordinate with certified integrator provisions for a credential reader with output allowing the elevator call button to be activated. A validated credential reader and updater will be required for activation.

- F. Final connections to fire alarm system, if required, by electrical and fire alarm system contractors.
 - 1. Provide permits, submittals and approvals required by the authority having jurisdiction, prior to commencing with work.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL EQUIPMENT AND SYSTEM FEATURES

- A. System: System is cloud based and supports all major browsers.
 - 1. Client Requirements:
 - a. Internet Browser: Firefox, Chrome, Internet Explorer, Edge or similar.
 - b. Internet access.
 - 2. System Features:
 - a. 5,000 unique user credentials.
 - b. Unlimited credential updaters (with door control).
 - c. User-definable schedules and revalidation periods.
 - d. Unlimited user-definable access for authorized users to system services.
 - e. Unlimited provisioning of mobile credentials for system users.
 - f. Remote and schedule unlock for online door controllers.
 - g. Remote reboot and remote firmware upgrade of online controllers.
 - h. Access permissions with start and end dates and times for credential holders.
 - i. User definable emergency one-time-PIN code issuance for offline locks.
 - j. Unlimited cloud accessible audit history.
 - k. Visibility of online status of online openings.
 - l. System export capabilities to .CSV file format.
- B. Mobile Configuration Application: Provide a configuration application which is compatible with Android 5.0 or later and offers NFC (Near Field Communication) capabilities.
 - 1. Configures time, date and system association for both offline locks and online updaters.
 - 2. Assigns unique identities to all devices within the system.
 - 3. Communicates lock information- lock type and firmware version to the cloud service.
 - 4. Displays locally retrieved audit trail from offline locks.
 - 5. Controls local lock settings and master code.
 - 6. Resets offline locks to factory default.
 - 7. Offline lock firmware upgrade over the air via NFC or BLE.

- C. Mobile Access Application: For residents and staff who desire to use a mobile device to access offline locks and/or online updaters- must have internet connectivity to receive the mobile credential and the device must be either Android 5.0 or IOS 13.
 - 1. Stores SEOS credential in secure element of the mobile device.
 - 2. Revalidates mobile credential when an internet connection is established.
 - 3. Communicates access privileges to both offline locks and online openings.
 - 4. Provides positive visual, and optional audible, and vibratory feedback about the status of credential transaction in real time.
 - 5. Communicates transaction information to the cloud when an internet connection is established.
- D. Offline System Operation: This facility will operate with offline lock access control of common area and resident doors. Updates are provided to the physical credential by presentation to the online updater after updates in the cloud system which may be operating as either a door controller or as an enrollment station. Updates are provided to the mobile credential “over the air” via an active internet connection.
- E. The facility will operate with the control of online updaters if physical credential access is required. If only mobile access is required, the facility may optionally operate without the control of online updaters.
- F. Manufacturers:
 - 1. Yale Locks and Hardware (YA) – Data-on-Credential compatible with the Yale Multi-Family Access Management Software System.

2.2 SYSTEM COMPONENTS AND TECHNOLOGY

- A. The system shall provide the ability for online operators to operate as online doors for the purposes of both access control and encoding/updating credentials. Provide the necessary network and lock components to create an online lock control system at the perimeter of the building. Utilize standard Ethernet and Power over Ethernet (PoE) as the communication backbone between the system server and the wired (on-line) doors and updaters.
- B. Functionality:
 - 1. Online updaters must function as an offline locking system by continuing to grant access to authorized users if online communication is interrupted but continuous power is still applied.
 - 2. Must provide real-time control of online updaters and access privileges of individual users from a central or remote location.

3. Must allow resident and staff credentials to be changed, extended, or revoked from cloud system. Resident credentials are automatically revoked upon move-out or expiration of a lease and allowable access timeframe.
 4. Credential holders shall be able to obtain a one-time PIN code from the systems software with proper authorization by the site administrator for emergency access to offline locks.
 5. Must be possible to display access audit trails, low battery events, and system access in the cloud system. Additionally, audit trails from offline locks must be visible from the mobile configuration application via local lock retrieval.
 6. Must be possible to issue multiple mobile and physical credentials per user.
- C. Lock Communication: Provide locks with RFID and BLE read/write capabilities to provide the communication link between the system server and the lockset over data-on-credential transport mechanism.
- D. Credential Updaters/Controller combination: Provide Yale R10/40 OSDP SE BLE Updaters compatible with: ISO 14443A. Provide system capable of supporting an unlimited number of online updaters acting as single door controllers and/or credential enrollment stations. Controller directly connects into the LAN/WAN network, using DHCP, DNS and TCP/IP addressing. Controller can be powered by PoE switches (specified in the electrical section), or by a 24VDC power supply. Controller shall offer a manual configuration lock option to prevent unauthorized configuration of the online updater.

2.3 DATA-ON-CREDENTIAL ACCESS CONTROL LOCKS

- A. Data-on-Credential Access Control Cylindrical Locks: ANSI/BHMA A156.2 Series 4000, Grade 1 cylindrical lockset with integrated key pad for access and programming. Voice guided programming and master PIN code security for settings. Optional key override feature to accept standard, interchangeable core, security, and patented cylinders.
1. Fully-encrypted AES 128 NFC and BLE wireless communication between lock and Yale Seos® credentials.
 2. Seos® credential reader included within the lock.
 3. Motorized locking and unlocking.
 4. Programming Language: English (default), Spanish, or French.
 5. Firmware upgradable over the air via configuration application.
 6. User Interface:

7. Audit Trail:
 - a. 200 locally retrievable audit events.
 - b. Unlimited audits in the cloud management system.
 8. Unlocking Modes:
 - a. Key override (momentary)
 - b. One time PIN code (4-8 digits)
 - c. Yale SEOS card, fob or mobile credential.
 9. Locking Modes:
 - a. Automatic relocking with available variable timing.
 - b. One touch keypad locking.
 - c. Yale SEOS card, fob or mobile credential (with one touch locking off).
 - d. PIN Code keypad locking (prior to commissioning).
 - e. Locking button on interior escutcheon.
 10. Electronic lock access options:
 - a. Up to 25 4-8 digit PIN codes (prior to commissioning).
 - b. One time PIN code (after commissioning).
 - c. Yale Seos® credentials (after commissioning).
 11. Power Source:
 - a. 4 AA alkaline batteries (standard).
 - b. External 9 VDC regulated power supply (alternative).
 - c. 9 VDC transistor battery backup terminal at the keypad (emergency).
 12. Manufacturers:
 - a. Yale Commercial (YA) – nexTouch NTB600-ACC Series.
- B. Data-on-Credential Access Control Exit Device Trim: ANSI/BHMA A156.3, Grade 1 exit trim with integrated keypad for access and programming. Voice guided programming and master PIN code security for settings. Optional key override feature to accept standard, interchangeable core, security and patented cylinders.
1. Fully-encrypted AES 128 NFC and BLE wireless communication between lock and Yale Seos® credentials.
 2. Seos® credential reader included within the lock.
 3. Motorized locking and unlocking.

4. Automatic door handing learning procedure.
5. Programming Language: English (default), Spanish, or French.
6. Firmware upgradable over the air via configuration application.
7. User Interface:
8. Audit Trail:
 - a. 200 locally retrievable events.
 - b. Unlimited audits in the cloud management system.
9. Unlocking Modes:
 - a. Key override.
 - b. One time PIN code (4-8 digits).
 - c. Yale SEOS card, fob or mobile credential.
10. Locking Modes:
 - a. Automatic relocking with available variable timing.
 - b. One touch keypad locking.
 - c. Yale SEOS card, fob or mobile credential (with one touch locking off).
 - d. PIN Code keypad locking (prior to commissioning)
 - e. Locking button on interior escutcheon.
11. Optional Modes:
 - a. Privacy mode.
 - b. Wrong Try Shutdown.
 - c. Passage Mode.
12. Lock access options:
 - a. Up to 25 4-8 digit PIN codes (prior to commissioning).
 - b. One time PIN code (after commissioning).
 - c. Yale Seos® credentials (after commissioning).
13. Power Source:
 - a. 4 AA alkaline batteries (standard).
 - b. External 9 VDC regulated power supply (alternative).
 - c. 9 VDC transistor battery backup terminal at the keypad (emergency).
14. Rim exit device compatibility:

- a. Yale: 1800, 2100, 2150, 6100, 6150, 7100, 7150.

15. Manufacturers:

- a. Yale Commercial (YA) – nexTouch NTT600-ACC Series.

2.4 ONLINE CREDENTIAL UPDATERS/DOOR CONTROLLERS

- A. Contactless smart credential updaters to securely read information from and write access control data to 13.56 MHz contactless RFID smart credentials. The contactless smart credential updater is designed for use in the Yale Accentra Access Control system by providing:

1. Secure access control data exchange between the credential and the updater utilizing key diversification and mutual authentication routines.
2. Contactless smart credential updater to be designed for low current operation to enable migration from most legacy proximity applications without the need to replace existing electrified door hardware, wiring and/or power supplies.
3. Updater product construction suitable for both indoor and outdoor applications.
4. Updater available with either pig tail or terminal block wiring options.
5. Updater available in either mini-mullion or wall switch form factor.

6. Manufacturers (13.56 MHz iCLASS):

- a. Yale (YA) - NXT 610BLE/640BLE KIT (as specified).

2.5 CREDENTIALS

- A. Provide secure RFID credentials that meet NIST requirements for encryption and HIPAA requirements for patient information security as required by the access control system specified herein. Credential technology shall provide protection against surreptitious tracking of the credential by means of random Credential Serial Number (CSN) generation. Credentials shall additionally provide a second layer of anti-cloning encryption to eliminate credential duplication. Physical credentials are to be capable of resisting tearing, bending, scratching, and moisture.

- B. Contactless Smart Card Credentials: Card credentials incorporating an access control identification technology that utilizes 13.56 MHz radio frequency (RF) circuits in microchip form. The microchips are encoded and securely transmit the encoded information when activated.

1. Technology features:

- a. Available in 8K-Bytes.
- b. AES-128 bits cryptographic algorithms for data protection.

- c. Hardware chip integrating co-processor with high performance for cryptographic calculations with symmetric keys.
 2. Security features:
 - a. Programmable with one or several Secure Identity Objects® (SIOs®) for each application.
 3. Card credential technology contactless features:
 - a. Tri-technology: 13.56MHz credential supports Yale Accentra offline iCLASS SEOS and PACS online iCLASS SEOS technologies with 8K memory and 125kHz 26 bit proximity.
 4. Interoperability:
 - a. Fully supported by iCLASS SE® and multiCLASS SE® readers that can process SIO-enabled data formats. PACS online only supported by iCLASS SE readers with firmware Revision E or later.
 5. Quantity: Include three per resident room. Coordinate additional credential quantities with the facility manager.
 6. Manufacturers (13.56 MHz iCLASS SEOS):
 - a. Yale - NTX600-YALPRX-8K.
 - b. No Substitution.
- C. Key Fobs: Fobs incorporating an access control identification technology that utilizes 13.56 MHz radio frequency (RF) circuits in microchip form. The microchips are encoded and securely transmit the encoded information when activated.
 1. Technology features:
 - a. Available in 8K-Bytes.
 - b. AES-128 bits cryptographic algorithms for data protection.
 - c. Hardware chip integrating co-processor with high performance for cryptographic calculations with symmetric keys.
 2. Security features:
 - a. Programmable with one or several Secure Identity Objects® (SIOs) for each application.
 3. Fob technology features:

- a. 13.56MHz FOB supports Yale Accentra offline iCLASS SEOS and PACS online iCLASS SEOS technologies with 8K.
4. Memory interoperability:
 - a. Fully supported by iCLASS SE® and multiCLASS SE® readers that can process SIO-enabled data formats. PACS only supported by iCLASS SE readers with firmware Revision E or later.
5. Quantity: Include three per resident room. Coordinate additional fob credential quantities with the facility manager.
6. Manufacturers (13.56 MHz iCLASS Seos offline and online):
 - a. Yale – NTX600-YALFOB-8K.
 - b. No Substitution.

2.6 FABRICATION

- A. Fasteners: Provide system components manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.7 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances, labeled fire door assembly construction, and other conditions affecting performance.

- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of products including but limited to: front desk equipment and software, remote controllers, electromechanical exit devices, and unit room locks.
- B. Storage: Provide a secure lock up for materials delivered to the project but not yet installed. Control the handling and installation of items so that the completion of the work will not be delayed by material losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating unit and each door lock to ensure proper operation. Replace units that cannot be adjusted to operate as intended.

3.6 CLEANING AND PROTECTION

- A. Protect all components stored on construction site in a covered and dry place. Protect installed components during the construction phase. Install components at the latest possible time frame.
- B. Clean components as necessary to restore proper finish. Provide final protection and maintain conditions that ensure components are without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's managerial personnel on the correct use of the online updater, configuration application for the purpose of lock updates for time after battery changes, and cloud service components.
- B. Instruct Owner's managerial personnel on the location and navigation of the cloud service and configuration application user manuals in the cloud service.
- C. Instruct Owner's maintenance personnel to adjust, operate, and maintain electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. Refer to Section 087100, Door Hardware Schedule, for hardware sets.
- B. Manufacturer's Abbreviations:

END OF SECTION 281500.30

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Soil treatment with termiticide.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
 - 1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For termite control products, from manufacturer.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- D. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by manufacturer to install manufacturer's products.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Provide one of the following:
 - a. BASF Corporation, Agricultural Products; Termidor.
 - b. Bayer Environmental Science; Premise 75.
 - c. FMC Corporation, Agricultural Products Group; Dragnet FT or Baseline.
 - d. Amvac; Prelude.
 - e. Sygenta; Demon Max.
 - f. Control Solutions Inc.; Dominion.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, and piers; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Masonry: Treat voids.
 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116