

COLUMBIA COUNTY BOARD OF COMMISSIONERS

COLUMBIA COUNTY DETENTION FACILITY

ISSUED FOR PERMIT Documents – July 24, 2020

COLUMBIA COUNTY DETENTION CENTER

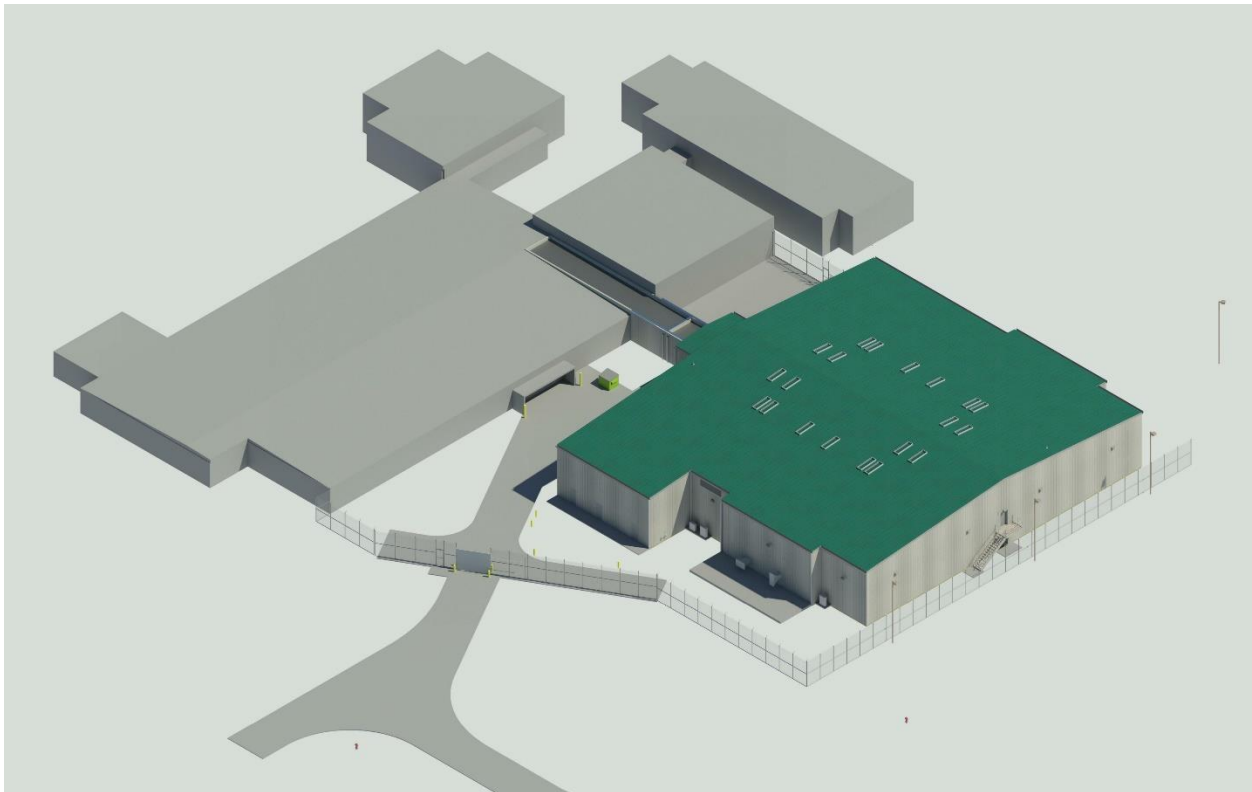
389 QUINTEN ST. LAKE CITY FLORIDA 32055

VOLUME 1

ISSUED FOR PERMIT SPECIFICATIONS

JULY 24, 2020

PROJECT # 50101397



SEALS PAGE - COLUMBIA COUNTY DETENTION FACILITY

Dewberry Project Number: 50101397 / ISSUED FOR PERMIT – July 24, 2020

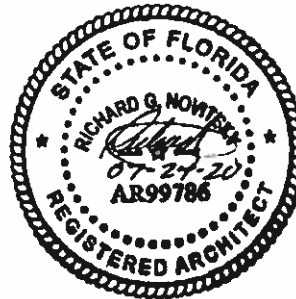
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DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Columbia County Detention Facility 95% Construction Documents, dated June 26, 2020, as modified by subsequent Addenda and Contract modifications.
- B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

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LIST OF DRAWING SHEETS

Dewberry Architects Inc. 50101397

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SECURITY & TELECOM

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TY-602	BLOCK DIAGRAMS – SECURITY / TELECOM

END OF DOCUMENT 000115

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. A geotechnical investigation report for Project, prepared by American Infrastructure Development, Inc., dated May 18, 2020, is available for viewing as appended to this Document.
 - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 003132

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ADD ALTERNATES

- A. Alternate No. 1:
 - 1. BASE BID: Half height Dayroom Upper Tier guardrails as indicated on Drawings.
 - 2. Alternate: Full height Dayroom Upper Tier guardrails as indicated on Drawings.
- B. Alternate No. 2:
 - 1. BASE BID – (Omit from design) Security Metal Vestibules from design at Housing Pod C along with associated electronic controls.
 - 2. Alternate: Provide Security Metal Vestibules at Housing Pod C
- C. Alternate No. 3:
 - 1. BASE BID: Provide Diesel Generator
 - 2. Alternate: Provide Natural Gas Generator & associated underground gas utilities to generator.
- D. Alternate No. 4:
 - 1. BASE BID: At each Precast Concrete Cell Location Intercom, back box and conduit is not required. (Omit from design).
 - 2. Alternate: Provide ONLY conduits and back box for future Inmate Intercoms at each Precast Cell Locations
- E. Alternate #5:
 - 1. BASE BID: Provide slab on grade at exterior door C158A
 - 2. Alternate: Provide exterior secured fenced in rec yard with 4" concrete slab on grade; Detention Grade ADA Toilet/ Sink Combi Unit; Det Grab Bars; Detention Grade ADA Hi Lo chilled water drinking fountain; 8" CMU privacy walls at toilet.
- F. Refer to Drawings:
 - 1. Refer to Structural drawings for Primary Structure, Secondary Framing, and Structural Bracing for Alternates #1, #2.
 - 2. Refer to Civil & Electrical drawings for underground Utilities and Equipment Slabs for Alternates #3.
 - 3. Refer to Electrical drawings for Lighting, Outlets, Controls, Panels and Circuiting for Alternates #2 & #3.
 - 4. Refer to Fire Protection drawings. For Alternates #2.
 - 5. Refer to TY series drawings for Security and Technology items for #2 and #4.
 - 6. Refer to QD Series Drawings for Detention items for Alternates #1, #2 and #4
 - 7. Refer to AS-101 Architectural Site plan; Civil C-101 and P-Series

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
 - 3. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

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 attached form.
 - 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.

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- 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: Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect. Use form included at the end of this section
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.

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- c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

DAI Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____
Trade Name: _____
Installer: _____ Address: _____

History: ☐ New product ☐ 1- 4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached – REQUIRED BY Dewberry (DAI)

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____

Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes: explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

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Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved – Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution approved as noted – Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution rejected – Use Specified materials.
- ☐ Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

END OF SECTION 012500

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

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

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1.3 ACTION SUBMITTALS

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

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

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4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
- 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 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect, through Construction Manager, will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 14 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 28 days for initial review of each submittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.

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4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect and Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect, through Construction Manager.
 5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will discard submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number, numbered consecutively.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

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3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal. Refer to the Conditions of the Contract for proposed deviations in the Contract Documents.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.
- I. 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.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return two copies.
 3. Informational Submittals: Submit 3 paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.

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- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Fabrication and installation drawings.
 - c. Roughing-in and setting diagrams.
 - d. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - e. Shopwork manufacturing instructions.
 - f. Templates and patterns.
 - g. Schedules.
 - h. Design calculations.
 - i. Compliance with specified standards.
 - j. Notation of coordination requirements.
 - k. Dimensions.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file for drawings 11 by 17 inches or less, or for any size drawing when there is no more than 10 sheets.
 - b. Drawings when there are more than 10 sheets: 3 opaque (bond) copies of each submittal. Architect, through Construction Manager, will return one copy. Architect, through Construction Manager, will return paper drawings as PDF's if requested. At the Architect's discretion, PDF's may be allowed on a case by case basis.
 - D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

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2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
3. 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 that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit 2 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
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. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- J. 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.
- K. 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.
- L. 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.
- M. 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.
- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

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- P. 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.
- Q. 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.
- R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- S. 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.
- T. 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.
- U. 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.
- V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- W. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
 - 1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

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2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect and Construction Manager.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

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

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

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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 -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, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.2 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. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

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2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- 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.

1.3 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

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appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For 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.

1.5 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. 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.
- D. 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.

1.6 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.

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- 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 E 329; 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. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

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- K. 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 or Construction Manager.
 - 2. Notify Architect and Construction Manager 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. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups when directed unless otherwise indicated.
- L. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 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. 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.

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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, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Construction Manager, 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. Contractor's Associated Requirements and 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 6. Security and protection for samples and for testing and inspecting equipment at Project site.

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- 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, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, unless otherwise indicated, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

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.

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- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager'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 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

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

1.2 INDUSTRY STANDARDS

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

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

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

1.3 ABBREVIATIONS AND ACRONYMS

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

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

ICC	International Code Council	(888) 422-7233
	www.iccsafe.org	

ICC-ES	ICC Evaluation Service, Inc.	(800) 423-6587
	www.icc-es.org	(562) 699-0543

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

CPSC	Consumer Product Safety Commission	(800) 638-2772
	www.cpsc.gov	(301) 504-7923

DOE	Department of Energy	(202) 586-9220
	www.energy.gov	

EPA	Environmental Protection Agency	(202) 272-0167
	www.epa.gov	

FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	

NIST	National Institute of Standards and Technology	(301) 975-6478
	www.nist.gov	

OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999

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

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA)	(202) 272-0080
	Accessibility Guidelines for Buildings and Facilities	
	Available from U.S. Access Board	
	www.access-board.gov	

CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	

FED-STD	Federal Standard	
	(See FS)	

FS	Federal Specification	(215) 697-2664
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil/	

Available from Defense Standardization Program
www.dsp.dla.mil

	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	

	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	

FTMS	Federal Test Method Standard	
	(See FS)	

UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 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 012300 "Alternates" for products selected under an alternate.
 - 2. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 014200 "References" for applicable industry standards for products specified.

1.2 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.

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1.3 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 and Construction Manager's Action: If necessary, Architect and Construction Manager will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect, through Construction Manager, 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, through Construction Manager, 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.

1.4 QUALITY ASSURANCE

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

1.5 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.

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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. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
5. Protect stored products from damage and liquids from freezing.
6. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 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.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 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 unless otherwise indicated.
 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.
 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.

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- 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 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. Installation of the Work.
 - 3. Cutting and patching.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting surveys.
 - 2. Section 017700 "Closeout Procedures" for final cleaning.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. 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. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 3. Dates: Indicate when cutting and patching will be performed.
 - 4. 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

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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.

- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Electrical wiring systems.
 - j. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Equipment supports.
 - d. Piping, ductwork, vessels, and equipment.
 - e. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner

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that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 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, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

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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. 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.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. 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, through Construction Manager.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to existing benchmarks and conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Lay out the Work using locally accepted 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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.

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5. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.

3.4 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. For elements and construction more than 4 inches from a floor to ceiling high wall, maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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- 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.

3.5 CUTTING AND PATCHING

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

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- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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 (27 deg C).

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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.
- 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. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

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- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 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 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.

1.2 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.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit 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.

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8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

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

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. 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.
2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. 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 and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

1.7 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.

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2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect, through Construction Manager, will return annotated document.

1.8 SUBMITTAL OF PROJECT WARRANTIES

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

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 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. Remove petrochemical spills, stains, and other foreign deposits caused by construction activities.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances.
 - e. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including plenums, shafts, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.

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- k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
- o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- p. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

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

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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.

1.2 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.

1.3 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 and Construction Manager.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

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- b. Enable inserted reviewer comments on draft submittals.
- 2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will return the reviewed copy.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect, through Construction Manager 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.
- D. Provide one hard copy version and one electronic version of the Operation and Maintenance manuals to the Owner.

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 and Construction Manager.
 - 7. 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.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm)

paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

- a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

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.

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- 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.

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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.

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- 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. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

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- G. 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 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 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Final Submittal: Submit one set(s) of marked-up Record Prints, one set(s) of Record Transparencies. Print each Drawing, whether or not changes and additional information were recorded.
 - b. Electronic Submittal: Submit one set of Record Prints in PDF format on a USB flash drive type storage device to the Owner, Construction Manager, and one set to the Architect. Each electronic file shall be named to match the name of the drawing sheet.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy 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 one paper copy of each submittal, unless otherwise indicated.

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

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. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Duct size and routing.
 - h. Locations of concealed internal utilities.
 - i. Changes made by Change Order or Construction Change Directive.
 - j. Changes made following Architect's written orders.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. 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.

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6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- 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. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

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

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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 paper copy and scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

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 paper copy and scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 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 and Construction Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 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.

1.2 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 and videographer.
- 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.

1.3 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 Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.

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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 prepared and bound in format matching operation and maintenance manuals.

1.4 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. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- C. Preinstruction Conference: Conduct conference at Project site. 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.

1.5 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 and Construction Manager.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Training Modules: For each module, include instruction for the following:
1. 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.
 2. 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.
 3. 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.
 4. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.

5. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
6. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
7. 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. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

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- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc or DVD acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

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- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
 - 1. 220800 – Commissioning of Plumbing
 - 2. 230800 – Commissioning of Mechanical
 - 3. 260800 – Commissioning of Electrical
- B. It is of primary concern that all systems and assemblies in the project perform in accordance with the design intent and the Owner's operational needs. The process of assuring that such performance is achieved is referred to as "commissioning."
- C. The Commissioning Team will include representatives of the Owner, Design A/E, General Contractor and Installing Subcontractors, Test and Balance Subcontractor, BAS Subcontractor and Commissioning Authority (CxA), (a.k.a., the commissioning professional (CxP))
- D. Commissioning is a comprehensive and systematic process of verifying that the building systems perform interactively in accordance with the BOD, according to the construction documents (and the owner's project requirements documents and architectural program to the extent those were generated for this project).
 - 1. The commissioning process shall encompass and coordinate the equipment and system documentation, equipment start up, field testing, control system calibration, testing and balancing, functional performance testing and training. Commissioning requires cooperation and direct involvement by all parties throughout the construction process.
 - 2. In addition to fulfilling scheduling and planning requirements, the Contractor is further responsible for documenting the equipment and system installation and operational verification for all systems and assemblies.
- E. Commissioning Process Overview: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 - 1. Various sections of the project specifications require equipment start-up, testing, and adjusting services. Requirements for start-up, testing, and adjusting services specified in the General Requirements, Division 22, Division 23, and Division 26 series sections of the specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.
 - 2. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning and performing product.
 - 3. The Commissioning Authority (CxA), is not responsible for the design, code compliance checking, construction means and methods, job safety, or management function related to commissioning on the jobsite.
 - 4. Commissioning begins with the selection of the Commissioning authority for the project and the development of the OPR document.

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5. Commissioning Plan: The commissioning plan provides guidance in the execution of the commissioning process. The Commissioning Authority will prepare and update the plan. The Specifications will facilitate the execution of the Commissioning Plan
6. Commissioning includes a kick-off meeting to discuss commissioning requirements with the commissioning team. The design team will typically produce the BOD documents or systems design narrative, the construction documents including plans and specifications.
7. Commissioning during construction begins with the kickoff meeting conducted by the Commissioning Authority where the commissioning process is reviewed with the commissioning team members.
8. The commissioning tool that will be implemented will be the cloud based CxAlloy©. The commissioning team members will be emailed “invitations” to login to the online tool and then complete the checklists using their own hand held tablet or cell phone. Neither the owner nor the CxA is responsible to provide the wireless tablet device (IOS). The startup checklists will be completed directly on their tablet and then uploaded, or synchronized when connected to a wireless network.
9. The Contractor schedules and develops start-up plans for selected equipment with review by the Commissioning Authority.
10. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with construction checklists being completed before testing.
11. The Commissioning Authority will review and document that the installation and start-up were completed through spot checking.
12. The Commissioning Authority performs periodic construction observations. The field observation reports will be promulgated by email from the CxAlloy© Cx Tool.
13. The Commissioning Authority develop specific written equipment, system and assembly Functional Performance Test (FPT’s) procedures for all commissioned equipment on the CxAlloy© Cx Tool and complete those using the tool on a tablet in the field.
14. The test procedures are executed by the Contractor, under the direction of, and documented by the Commissioning Authority for most equipment.
15. The CxA prepares the Preliminary Cx Report and provides this document to the Owner. The Owner sends the code official a letter of transmittal acknowledging that the building owner has received the Preliminary Commissioning Report.
16. Only after the Preliminary Cx Report is received by the Owner can the final mechanical inspection be scheduled with the Building Official / AHJ.
17. Items of non-compliance in material, installation or setup are documented by the Commissioning Authority and corrected by the Contractor.
18. Issues and deficiencies identified for follow up and resolution shall be developed in the CxAlloy© tool and posted to a Cx Issues log and will reside on the “cloud” accessible to all stakeholders to review and update the status of the items for which they are responsible.
19. Cx is completed and all deficiencies corrected prior to Substantial Completion.
20. The final Cx Report shall be submitted by the CxA to the Owner within 90 days of the receipt of certificate of occupancy.
21. The Commissioning Authority reviews the O&M manuals for clarity, accessibility and completeness.
22. Commissioning is completed before Substantial Completion, except for trend log monitoring, seasonal testing, and near-warranty end activities.
23. If required or if necessary, seasonal or deferred testing and near-warranty-end activities are conducted, as specified

1.2 COMMISSIONING AUTHORITY (CxA)

- A. The CxA services will be provided by or sub-contracted by the Architect. The Contractor is responsible to execute the Cx process according to this specification section.
- B. The CxA firm for this project will be:
 - 1. Mechanical Systems: TLC Engineering Solutions, Inc.
 - 2. Electrical / Lighting Systems: TLC Engineering Solutions, Inc.
 - 3. Service Water Heating Systems: TLC Engineering Solutions, Inc.

1.3 DESCRIPTION OF WORK INCLUDED

- A. The following equipment, systems, assemblies and features will be commissioned utilizing the traditional construction phase commissioning process
 - 1. Mechanical Systems:
 - a. HVAC systems
 - 1) Major equipment including AHUs, Heat Pumps, Boilers, etc.
 - 2) Minor equipment including FCUs, Unit Heaters, Exhaust Fans, and VAV/VTUs
 - b. BAS systems
 - 2. Electrical Systems:
 - a. Interior / Exterior Lighting Controls
 - 3. Service Water Heating
 - a. Domestic hot water Systems
 - b. Domestic water booster pumps

1.3 DEFINITIONS

- A. Approval: Acceptance that a piece of equipment, system or issue related to it complies with the Contract Documents.
- B. Basis of Design (BOD): Documentation of the primary assumptions and rationale behind design decisions that are made to meet the Owner's intent and project requirements. The BOD describes the assumptions used for sizing and selecting systems and components; site and environmental conditions or constraints; and other factors that led to decisions (e.g., codes, standards, operating conditions, functional goals, and interior environmental criteria).
- C. Building Automation System (BAS): The central building energy management control system.

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- D. Commissioning (Cx): Commissioning is a systematic process of ensuring that all building systems and assemblies perform interactively according to the Owner's objectives and requirements. This is achieved by beginning in the design phase and documenting the Owner's Project Requirements, Basis of Design (BOD) and continuing through construction, acceptance and the warranty period with actual verification of function and performance.
- E. Commissioning Authority aka Commissioning Provider (CxA): The professional commissioning consultant, not otherwise associated with the A/E team members, Contractor. The Commissioning Authority directs and coordinates the day-to-day commissioning activities in concert with the Contractor.
- F. Commissioning Plan (CxPlan): The project-specific document prepared by the CxA that describes all aspects of the commissioning process including roles & responsibilities, documentation requirements, and communication structures.
- G. Commissioning Team (CxT): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- H. CxAlloy™ is an online, cloud based, commissioning tool that shall be used to reduce paper, document progress and completion of checklists, post to and generate issues for followup as they are noted, resolved and status updated by the responsible party either in the field with their wireless tablet device using Cx Alloy or from a work station on the Cx Alloy project web page.
- I. Datalogging: Monitoring flows, currents, status, pressures, etc., of equipment using stand-alone dataloggers separate from the control system.
- J. Deferred Tests: tests that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- K. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the Owner's objectives).
- L. Functional Performance Test (FPT): The written procedures and documentation forms of tests used to guide and record testing. FPTs are composed of repeatable, step-by-step procedures and include the test prerequisites, the test process, the expected outcomes and acceptance criteria. Contractor: Refers to the Contractor, Construction Manager, Builder, and all sub-Contractor and/or authorized representatives
- M. Issues Log: Ongoing record of the issues identified during the commissioning process that require or did not require correction, and shall be maintained, posted, updated, directly online or via a wireless tablet on the CxAlloy™ platform. For each entry the log includes a unique identification number and a short description of the issue. The Commissioning Authority is responsible to maintain the log.
- N. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
- O. NETA: International Electrical Testing Association, Inc.

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- P. Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation).
- Q. Owner: The representative on the Project that has the authority to act in the Owner's behalf in all issues.
- R. Owner Project Requirements (OPR): Documentation of the functional requirements of the facility and the expectations of how it will be used and operated. This includes Project and design goals, measurable performance criteria, budgets and schedules and supporting information.
- S. Performance Metrics/Benchmark: Measurable indicators that allow verification that a specific Owner Objective or Requirement or element in the Design Narrative has been met. Performance Metrics are identified throughout the design of the Project with as many as possible being generated during the development of the Owner Objectives.
- T. Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.
- U. Pre-Functional Checklist (PFC). The CxA shall develop checklist for the contractor to use as startup checklist prior to operating the equipment for the function intended. Items shall include such items as release lockdown of vibration isolation, lubrication, belt tensioning and checkling, equipment level, drains clear, etc.) NOTE this PFC will not be in lieu of or be substituted by the manufacturer's required warranty startup checklist. Where warranty checklists are required, those shall be scanned and uploaded or transmitted to the CxA.
- V. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- W. Seasonal Tests: Tests that are deferred until the system(s) will experience conditions closer to their design conditions.
- X. Simulated Condition: Condition that is created for the purpose of testing the response of a system.
- Y. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.
- Z. Start-up: The initial starting or activating of dynamic equipment, including executing construction checklists.
- AA. Test: Assessments that verify specific components, assemblies, systems, and interfaces among systems function and perform in accordance with the Owner's objectives and the Contract Documents. Testing may include using manual (direct observation) or monitoring methods. Testing is the dynamic testing of specific and interacting equipment and systems in full operation. Tests are generally performed after construction checklists and start-up are complete. Some procedures in construction checklists test components, but reference to "testing" generally refers to those equipment and system tests conducted after Contractor startup and initial checkout.
- BB. Trending: Monitoring using the building control system.

1.4 RESPONSIBILITIES

- A. Overview: The responsibilities of the parties in the commissioning process are summarized in the matrix as provided in the Cx Plan. For detailed information on the various roles and responsibilities, refer to the paragraphs below the matrix. Additional responsibilities are found in other Sections of Division 1, General Requirements and the specifications and the commissioning plan.
- B. In general the CxA writes the tests and documents the test results. The Contractor is responsible to execute the tests.

Table 4.3: Commissioning Team Responsibilities

Task / Action	Responsibility				
	CxA	Owner	EOR	GC	SUBS
Cx Specifications	Write, Develop	Review	Incorporate	Review	Execute
Cx Plan	Develop, Maintain	Review	Review	Review	Review
Cx Kickoff Meeting	Lead	Attend	Attend	Attend	Attend
CxA site visits -To review progress.	Observe	Participate	Participate	Schedule	Participate
Equipment Start-up & checkout (PFC)	Observe, Document	N/A	N/A	Schedule, Attend	Execute
Test and Balance	Review, Observe, Document	N/A	Approve	Schedule	Execute
Functional Performance Test Development (FPT)	Write, Develop	Review	Review	Review	Review
Functional Performance Test Execution (FPT)	Lead, Observe, Document	Observe	Observe	Schedule, Attend	Execute
Cx Issues Log	Document	N/A	Review	Verify Completion	Address, Correct Issues
Operations and Maintenance Manuals & Warranty	Review	Receive	Approve	Verify Completion	Develop, Provide
Final Cx Report	Develop	Review	N/A	N/A	N/A
Off-Season FPT	Lead, Observe, Document	Observe	Observe	Schedule, Attend	Execute
Notes: - The parties shall follow the Cx plan and attend Cx kick-off meeting and additional meetings, as necessary. - The CxA coordinates the Cx process with help from the Owner's Representatives and GC. - The GC shall ensure that subcontractors perform their responsibilities, integrate Cx into the construction process and schedule, and shall signoff on the system performance following the functional testing process.					

Task / Action	Responsibility				
	CxA	Owner	EOR	GC	SUBS
4. The EOR shall provide the System Narratives and BOD to the commissioning team, perform construction observations, approve O&M manuals and assist in resolving issues. The EOR team is also responsible for reviewing and addressing the design review comments generated by the Cx during the Cx design review period.					
5. The sub-contractors shall demonstrate and sign-off on proper system performance and shall verify O&M manuals and owner training.					

1.5 SUBMITTALS

- A. The Contractor shall provide the Commissioning Authority with information required to facilitate the commissioning process from written requests.
- B. The CxA shall be provided with one copy of all submittals of the systems' components to be commissioned, shop drawings, operation and maintenance (O&M) manuals, Test Adjust & Balance (TAB) reports, other tests conducted outside of the Cx process, and Owner training plans related to the systems being commissioned for review concurrent with the design professionals (A/E). All of the above shall be provided in searchable pdf format and/or Microsoft word .doc or .docx format.
- C. The Contractor shall provide documentation required for Cx activities to CxA at least two weeks in advance of scheduled Cx activity and include same in O&M manuals. Such project-specific documentation shall include manufacturer and model number of all equipment and components, manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, startup plan(s), installation & checkout materials shipped inside equipment, and checkout forms used by factory or field technicians.
- D. O&M MANUALS: The Contractor shall prepare O&M manuals, including clarifying and updating the original sequences of operation to as-built conditions, and submit to the owner within 90 days of the date of receipt of the certificate of occupancy.
 - (1) CxA Review: Prior to Owner training and Substantial Completion, the CxA will review the Operation and Maintenance (O&M) manuals, documentation, "redline" as-builts, and warranty information for all commissioned systems. Deficiencies will be communicated to Owner and the A/E for consolidation with other review comments and resolution/correction by the Contractor.
 - (2) Single Line System Diagrams. The Contractor shall provide simplified professionally drawn, computer generated single line system diagrams on 8 1/2" x 11" or 11" x 17" sheets.
 - (3) These shall show major pieces of equipment such as pumps, heat exchangers, air handling equipment, coils, control valves, expansion tanks, coils, service valves, etc. In some cases, the single line control diagrams submitted by the Contractor can suffice if updated to as-built status and approved by the Owner and CxA for this purpose.
- E. Preliminary TAB Report: The Contractor shall provide the testing and balancing by an agency certified per the specification to test and balance the flows and pressures and temperatures and generate a Preliminary TAB report which shall be provided both the CxA and the Owner prior to substantial completion.

- F. Preliminary acceptance documents acknowledgement. The Owner must in writing communicate to the authority having jurisdiction they have received both the Preliminary TAB report and the Preliminary Commissioning Report in order to get a final inspection by the authorities and prior to being issued a certificate of occupancy or temporary certificate of occupancy.
- G. Final acceptance Documents: The Contractor shall submit the final System Balancing (TAB) Report and the Cx A must submit the final Cx Report within 90 days of the receipt of the certificate of occupancy, The documents must describe the activities and measurements completed, sensors calibration , and status of resolution of the issue log at the time of submittal to the Owner within 90 days of the date of receipt of the certificate of occupancy.
- H. Record Drawings: Final record drawings shall be prepared by the Contractor, and submitted to the owner within 90 days of the date of receipt of the certificate of occupancy

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The Contractor shall provide all specialized tools, test equipment, and instruments required to execute startup, checkout, and FPT of systems and equipment.
- B. Test equipment shall be of sufficient quality and accuracy to test and/or measure system performance according to specified tolerances.
 - (1) Test instruments shall bear a valid NIST-traceable calibration stamp.
 - (2) Frequency of calibration shall be in accordance applicable NEBB, AABC, or IEEE requirements.
- C. All standard testing equipment required for the Contractor to perform installation, start-up and initial checkout and required testing shall be provided by the Contractor.
- D. Special tools and instruments, only available from vendor, specific to a piece of equipment, required for testing equipment according to these Contract Documents shall be included in the base bid price.
- E. The Contractor shall provide data-logging equipment for setting up and testing of the systems included in the Commissioning Plan and any additional specialty systems or areas as deemed necessary by the CxA.

2.2 TEST EQUIPMENT CALIBRATION:

- A. The Contractor shall submit, within 90 days of notice to proceed and 30 days before any testing is performed, documentation of meeting the following calibration requirements.
- B. Electrical equipment testing instruments must be calibrated in accordance with the following frequency:
- C. Field Instruments: Analog, 6 months maximum, digital, 12 months maximum.
- D. Laboratory Instruments: 12 months.

- E. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.
- F. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.
- G. If not otherwise given, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degrees F and a resolution of + or - 0.1 degrees F.
- H. Pressure sensors shall have an accuracy of + or - 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Scheduling: The Contractor shall provide sufficient notice to the Commissioning Authority regarding the installation of static assemblies being commissioned and the schedule for the construction checklists, start-up and initial checkout of all commissioned dynamic equipment and systems.
- B. Meetings: The Contractor will coordinate with the Commissioning Authority in a number of areas as described in this Section in order to facilitate the successful completion of the commissioning plan.
- C. Planning Meeting: Within 30 days of commencement of construction, the Commissioning Authority will schedule, plan and conduct a commissioning planning meeting with the Architect, and mechanical and electrical engineering sub-consultants, the Contractor, Owner and facility operator or representative. During this meeting, the overall scope and process of the commissioning effort for this Project will be described, issues and suggestions from all parties given, management and reporting protocols finalized and the Project schedule discussed. From information gathered in this meeting, the Commissioning Authority will update the Commissioning Plan preparatory to the commissioning kick-off meeting. Meeting minutes will be distributed to all parties by the Commissioning Authority.
- D. Kick-off Meeting: Within 60 -90 days from the start of construction, the Commissioning Authority will schedule, plan and conduct a commissioning kick-off meeting with the entire commissioning team in attendance, including the controls, sheet metal, electrical, mechanical, test, adjusting and balancing and other appropriate sub-contractors, and the facility operator or representative in attendance. One week prior to this meeting, the updated commissioning plan will be distributed to all members for their review. The commissioning plan, the overall commissioning process and general responsibilities of each team member, reporting and communication protocols and next steps will be discussed. Meeting minutes will be distributed to all parties by the Commissioning Authority.
- E. Temporary or Early Startup of Equipment. When equipment will be used in a temporary mode prior to operating the equipment permanently, a meeting shall be held that discusses the issues

surrounding indoor environmental quality, moisture intrusion, building pressurization, duct and equipment cleanliness, checkout of safeties and fire alarm and protection, etc.

- F. Miscellaneous Meetings: Deficiencies in compliance with the contract documents identified through the commissioning process or other means shall be discussed, as needed, in portions of regular construction meetings.
- G. The Commissioning Authority will plan, conduct and take minutes at commissioning meetings. Minutes will be published via the CxAlloy Cx Tool.
- H. Commissioning meetings will be scheduled to coincide with regular construction meetings or OAC meetings.
- I. All commissioning meetings shall be attended by the Contractor, and all appropriate or requested sub-contractors.
- J. The number of site visits / field observations visits and concurrent specific meetings dedicated to commissioning is provided in the Commissioning Plan and shall be schedule with the Contractor. If the number of deficiencies is abnormal or coordination or cooperation is insufficient, additional meetings or meeting durations shall be required.
- K. Controls Integration Meetings: The Commissioning reviews the control drawings, sequences of operation, points list and database and controls submittal requirements. The Cx A may require meetings to formally control drawing submittal and any programming. The intent is to clarify control related issues for the Contractor, and appropriate sub-Contractor, Owner facility staff and Commissioning Authority prior to final point database development, programming and the formal control drawing submittal.
 - (1) The Contractor and appropriate sub-Contractor shall attend all commissioning related meetings. The mechanical and electrical designers attend as or if needed or if desired according to their contracts. The control technicians attending the meetings must be the same technicians that are/will install and program the DDC system.
 - (2) Preliminary control drawing submittals and sequences by system are provided by the Contractor, reviewed beforehand and discussed at these meetings.
 - (3) A site visit or walk-through with the Contractor, Commissioning Authority and Engineer shall be conducted where precise locations of panels, sensors, thermometers, flow meters and stations and valve taps will be identified.
 - (4) The Commissioning Authority takes minutes at these meetings, which may include marked up of documents, shop drawings, control documents or sequences of operation, Issue Log, checklists, etc. All commissioning design references and documents shall be posted and stored on the Cx Alloy TM project web site.

3.2 START-UP, AND INITIAL CHECKOUT

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1 Systems to be commissioned
- B. Manufacturer Installation and Startup Procedures:
 - (1) The Contractor shall document their installation and startup utilizing manufacturer installation and startup procedures, check sheets and reports, in addition to the commissioning checklists.

- (2) The completed manufacturer startup reports shall be submitted to the Commissioning Authority within 5 days of startup. The Contractor shall clearly note any items that have not been completed and the plan for their completion.

C. Execution of Pre-Functional Checklists and Start-up:

- (1) Each piece of equipment shall receive full construction checkout by the Contractor following the approved plan and forms. No sampling strategies are used. Only individuals that have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall initial or check that item off. It is not acceptable for non-witnessing supervisors to fill out the forms.
- (2) The Contractors shall complete the pre-start procedures in the checklist prior to starting equipment, including but not limited to verification of completion of wiring, safeties, lubrication, drive rotation and proper electrical test readings. Startup shall be conducted under supervision of responsible manufacturer representatives for major pieces of equipment. The Contractor shall notify the Commissioning Authority at least 5 days in advance of any equipment start-up, providing the Commissioning Authority a copy of the pre-start sections of the installation and start-up plan at that time.
- (3) The Commissioning Authority shall observe installation, start-up and checkout of selected systems. Procedures on the plans and checklists will be spot-checked by the Commissioning Authority prior to testing.
- (4) The Contractor shall execute start-up and provide the Commissioning Authority with a signed and dated copy of the completed construction checklists and installation and start-up documentation. The Contractor shall clearly note any items that have not been completed and the plan for their completion.
- (5) The Contractor shall operate each commissioned device or assembly to the full extent of its capability, from minimum to maximum, under automatic and manual control and verify that the equipment, system and assembly is functioning according to the specifications, manufacturer's recommendations and good operating practice.
- (6) The Construction Checklist and manufacturer installation and startup check sheets and procedures for a given system shall be successfully completed and submitted prior to formal testing or testing, adjusting and balancing of the equipment.
- (7) Where final balancing of a system or particular components are not specifically indicated to be performed by the Owner or Owner's consultants, the Contractor and Contractor shall provide final balancing and adjustments for operation within specified tolerances prior to testing and demonstration of such system.
- (8) The Contractor shall submit installation, startup and checkout documentation prior to testing equipment.
- (9) The Commissioning Authority will review installation, startup and checkout documentation and identify incomplete areas.
- (10) The Contractor shall correct all areas that are deficient or incomplete in the checklists in a timely manner.

3.3 PHASED START-UP AND TESTING

- A. The Project may require start-up and initial checkout to be executed in phases. This phasing will be planned and scheduled in detail in coordination meetings. Results will be added to the master schedule.
- (1) The intent of this phasing is to ensure that sufficient chilled and heating water and electrical power (including backups) are confidently available to the systems serving the project.

- (2) This will require that primary equipment will be started, partially balanced and fully functionally tested and put into active operation. Then, later as ancillary and secondary portions of the primary equipment are finished and tested, both primary and secondary systems shall be functionally tested as a complete system, with some primary system functions being tested twice.
- B. Any equipment started up or tested which later is modified shall have affected portions or potentially affected portions of equipment, sequences and interlocks retested to ensure that the entire system or assembly functions properly.

3.4 FUNCTIONAL TESTING

- A. The Contractor shall be responsible to fully test all systems and assemblies according to the Specifications. The Commissioning Authority will direct, witness and document most of the mechanical systems tests.
- B. The Contractor shall provide all calibrated test instruments and execute all tests, except at the discretion of the Commissioning Authority and approval of the Contractor, the Commissioning Authority may execute tests of selected equipment.
- C. The Commissioning Functional Tests for a given system or assembly shall not be conducted until they are fully operational under normal and reliable control with control calibrations, programming and control system graphics complete and certified by the controls contractor to have been functionally checked in all sequences and the Contractor have submitted a completed construction checklist and where applicable a startup report, satisfactory to the Commissioning Authority.
- D. Objectives and Scope:
 - (1) The objective of testing is to demonstrate that each system is operating according to the documented Owner Objectives and Contract Documents. For dynamic systems, testing facilitates bringing the systems from a state of initial operation to full dynamic operation. For static elements, testing verifies the performance of the assembly in its installed state under conditions specified in the testing requirements. Additionally, during the testing process, areas of deficient performance are identified and corrected.
 - (2) In general, testing shall include each item in the sequence of operations, and other significant modes, sequences and control strategies not mentioned in the written sequences; including, but not limited to startup, shutdown, unoccupied and manual modes, modulation up and down the unit's range of capacity, power failure, alarms, component staging and backup upon failure, interlocks with other equipment, and sensor and actuator calibrations.
 - (3) All interlocks and interactions between systems shall be tested.
 - (4) All larger equipment will be individually tested. Like units or assemblies that are numerous (many smaller rooftop packaged units, air terminal units, exhaust fans, windows, etc.) may have an appropriate sampling strategy applied. Heating equipment must be tested appropriately during winter and air conditioning equipment must be tested appropriately during summer to demonstrate performance under near-design conditions.
- E. Development of Functional and Performance Test Procedures:

- (1) Test procedures and online CxAlloy™ documentation checklists or paper version of same are not finalized until after equipment and control system submittals and shop drawings are approved.
 - (2) The CxA obtains needed documentation which generally includes equipment Specifications, testing requirements, O&M manuals, approved submittals and shop drawings, start-up instructions, sequences of operation, and mechanical, electrical and control drawings and writes detailed step-by-step testing procedures to comply with the testing requirements.
 - (3) Prior to execution, any test procedures developed by the Commissioning Authority are provided to the Contractor via CxAlloy™ (or a paper version) who shall review the tests for feasibility, safety, equipment and warranty protection.
 - (4) Prior to execution, test schedule, test plan, and completed start up forms developed by the Contractor are reviewed and approved by the Commissioning Authority.
 - (5) Test schedule, plan and procedures shall be written and submitted to reviewers at least 14 days prior to executing the tests.
- F. The Commissioning Authority will review Owner-contracted, factory testing, required Owner-witnessed acceptance tests and tests conducted by regulatory authorities which the Commissioning Authority is not responsible to oversee, including documentation format, and will determine what further testing or format changes may be required to comply with the Specifications and rigor desired by the Owner. Redundancy of testing shall be minimized. Documentation of these tests will be included in the Commissioning Record.
- G. Test and Verification Methods:
- (1) Testing and verification for most dynamic equipment shall be achieved by an appropriate combination of active testing (persons manipulate the equipment and observe its function) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data-loggers. For certain tests documenting with photographs, video or audio recordings may be appropriate. The testing requirements sections of the Specification describe which methods shall be used for each test. The Commissioning Authority may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner.
 - (2) Simulated Conditions: Simulating conditions other than by overwriting a value shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 - (3) Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
 - (4) Simulated Signals: The BAS technician may override the actual sensor signal which creates a simulated signal to test the sequence programmed to comply with the design sequence. The actual signal shall be calibrated by the calibrated test instruments provided by and used by the (TAB) Contractor. The calibration of the sensors and transducers and

- DDC constants is to be completed and documented in the startup point to point checks using the calibrated instrument compared to the sensor reading values.
- (5) Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable.
- H. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during construction checklists and calibrations.
- I. Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc., to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.
- J. Testing Order: In general, testing is conducted after Pre-Functional Checklists and start-up has been satisfactorily completed. The control system is sufficiently tested and approved by the Commissioning Authority before it is used for testing, adjusting and balancing or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before testing of air-related or water-related equipment or systems. Testing generally proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is verified.
- K. Trend Logs and Monitoring: Trend logs required in the testing requirements shall be set up and executed by the Contractor and provided to and analyzed by the Commissioning Authority. Monitoring using data-loggers will be conducted by the Commissioning Authority. Trend logs and monitoring are conducted after active testing and subsequent trouble-shooting are complete and systems are in normal operation without frequent service shutdowns, etc.
- L. Problem Solving: The burden of problem solving is on the Contractor and the Designers, though the Commissioning Authority may recommend solutions to problems found.
- M. Sampling: The following is a summary of the systems that are intended to be Functional Performance Tested as part of this project.
- (1) **The Contractor is responsible for testing 100% of all systems and components as part of their normal scope of work.** The table offers a descriptive listing of equipment and components which will be tested and witnessed by the CxA for each of the typical systems during the commissioning process.
- (2) If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Authority may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units. Deficiency correction time and follow-up tests shall be required when deficiencies are discovered.
- N. The costs for extensive retesting or expanded sample Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting or expanded sample testing by the

Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

Commissioning Sampling Rate			
System	Description	Sampling Rate	Failure Limit
Mechanical	Central Plant Cooling Equipment (includes chillers, pumps, cooling tower)	100%	10%
Mechanical	Central Plant Heating Equipment (includes boilers, pumps)	100%	10%
Mechanical	Major Equipment, including Air Handling Units, Split Systems, & Packaged Rooftop Equipment (nominal 10 tons and larger each)	100%	10%
Mechanical	Minor Equipment, including Split Systems & Packaged Rooftop Equipment (smaller than 10 tons each), Fan Coil Units	If 1-10 on project: 100% If 11-20 on project: 50% If 21-30 on project: 25% If >30 on project: 10%	10%
Mechanical	Terminal Units (VAV)	25%	10%
Mechanical	Unit Heaters	10%	10%
Mechanical	Exhaust Fans (1 hp & larger)	25%	10%
Mechanical	HVAC Controls	10%	10%
Mechanical	TAB Services (measured data)	10%	10%
Electrical	Interior Building Lighting Controls	25%	10%
Electrical	Exterior Building Lighting Controls	25%	10%
Plumbing	Water Heaters	50%	10%
Plumbing	Hot Water Circulating Pumps	50%	10%
Plumbing	Domestic Water Booster Pumps	50%	10%
Plumbing	Hot Water System Controls	25%	10%

3.5 ISSUES AND NON-CONFORMANCE

- A. The Commissioning Authority will record the results of document reviews, field observations, tests conducted or reviewed and trend logs or monitoring. All deficiencies or non-conformance issues will be recorded on a master Issues Log kept by the Commissioning Authority. The Issues Log will be kept updated by the Commissioning Authority.
- B. A current copy of the Issues Log will be provided to the Contractor and Owner on a regular basis, as requested by the Contractor or Owner. New issues since the last printing will be clearly identified.
- C. Issues warranting a request for information (RFI) will be forwarded by the Commissioning Authority to the designated party for developing the RFI, or the Commissioning Authority will generate and forward the RFI directly.

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- D. Issues of non-compliance or items that are incomplete or are requiring Designer input will be sent to the Contractor or Designer and Owner by the Commissioning Authority via appropriate channels.
- E. When completion of a task or other issue has been identified by the Commissioning Authority as holding up or is likely to delay any commissioning process, particularly functional testing, the Contractor or Designer, as applicable, shall respond within two days of notification of the issue, to notify the Commissioning Authority in writing providing the planned actions and an expected date of completion. The Contractor shall notify the Commissioning Authority in writing within one day of completion listing the actions taken to resolve the issue. It is not the responsibility of the Commissioning Authority to obtain this status information through meeting attendance, asking questions or field observation.
- F. The Commissioning Authority documents resolutions in the Issues Log and schedules retesting and re-inspection as needed.
- G. Corrections of minor issues identified may be made during the tests at the discretion of the Commissioning Authority and with the issue and resolution documented in the Issues Log.
- H. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Authority will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the written request of the Owner.
- I. Cost of Retesting: The Contractor shall reimburse the Owner and Commissioning Authority for costs when a scheduled test cannot be completed due to, but not limited to the following:
 - (1) Failure of the Contractor to schedule the test with all parties required to perform the test or with regulatory authorities required to witness the test.
 - (2) Failure of the Contractor to provide required notice for tests that have been cancelled or rescheduled.
 - (3) Failure of the Contractor to have in place test equipment, support equipment, instrumentation, permits, or other ancillary equipment or systems required for successful execution of the test.
 - (4) Failure of the Contractor to complete pre-start or start-up procedures or other work required as a prerequisite for execution of the test.
- J. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or time extension by the Contractor.

3.6 APPROVAL AND ACCEPTANCE:

- A. The Commissioning Authority will note each satisfactorily demonstrated function on the test form. However, formal approval of an entire test form is not normally given. Functional approval or acceptance of a system is indicated after all testing and monitoring is complete and there are no outstanding issues for that equipment or assembly in the Commissioning Authority's Issues Log.

3.7 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and testing may be delayed upon written approval of the Owner.
- B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in the testing requirements shall be completed as part of this contract. The Commissioning Authority will coordinate this activity. Tests will be executed, documented and deficiencies corrected by the Contractor, with facilities staff and the Commissioning Authority witnessing. The Contractor shall make needed final adjustments to the O&M manuals and Record Documents due to the testing results.

3.8 SCHEDULE

- A. The Owner and Contractor shall work with the Commissioning Authority using established protocols to schedule the commissioning activities.
- B. The Owner and Contractor shall integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. As construction progresses, more detailed commissioning schedules shall be developed.
- C. The Contractor shall provide a minimum of 2 weeks' notice prior to the date of testing to the Owner and Commissioning Authority. In addition, the Commissioning Authority and Owner shall be notified 48 hours in advance when tests are canceled or rescheduled.

3.9 OWNER TRAINING

- A. The Contractor is responsible to provide training for Owner personnel per the Contract Documents. The Contractor shall work with the Commissioning Authority to develop appropriate training and orientation agendas for equipment and assemblies and provide skilled trainers for the sessions.
- B. The Commissioning Authority will ensure that the Contractor executes training per the Contract Documents and will provide a brief system overview at the beginning of the training sessions for the primary equipment.
- C. Provide training in accordance with Commissioning Plan and Specifications.
- D. Provide a draft training plan for review and approval within 30 days following associated O&M data approval.
- E. Provide final training plan a minimum of 30 days prior to the associated O&M Training.

END OF SECTION 019113

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SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

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

1.4 MATERIALS OWNERSHIP

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

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1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

1.6 CLOSEOUT SUBMITTALS

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

1.7 FIELD CONDITIONS

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

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

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- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

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2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Coordinate excessive noise generating operations with Owner, to minimize disruption to the library patrons, and shall be performed prior to 10:00 am.

3.4 SELECTIVE DEMOLITION, GENERAL

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- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. Dispose of demolished items and materials promptly.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

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

3.6 CLEANING

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

END OF SECTION 024119

SECTION 031000 – CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESIGN FORMWORK

- A. Assume all responsibility for the design and engineering of the formwork, as well as its construction and removal.
- B. Design formwork for the loads, lateral pressure, and allowable stresses outlined in Chapter 2, "Guide to Formwork for Concrete", ACI 347, latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Facing Materials shall be such as to provide the specified surface finish.
- B. Form Coating shall be a field applied chemical concrete release agent capable of preventing bond between poured concrete and the form and shall contain no oil, or shall be factory applied non-absorptive liner. Coat form before reinforcement is placed.
- C. Form Ties shall be broken back at 1-inch from surface of concrete. Tie Cones, 1-inch diameter by 1-inch long, shall be used on all exposed concrete.
- D. Pre-molded Expansion Joint material (E.J.) shall conform to ASTM D1751, "Preformed Expansion Joint Fillers for Concrete Paving and Structural Concrete (non-extruding and resilient bituminous types)".

2.2 FABRICATION

- A. Construct formwork so that concrete surfaces will conform to the tolerance limits specified in Table 4.3.1, "Tolerances for Formed Surfaces", ACI 301, latest edition.
- B. Provide positive means of adjustment (wedges or jacks) of shores and struts to compensate for anticipated deflections and settlement in the Formwork during concrete placing operations.

PART 3 - EXECUTION

3.1 ERECTION OF FORMS

- A. Build forms tight to prevent loss of mortar from the concrete.

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- B. Provide clean-out openings at base of pier and wall forms to facilitate cleaning and observation immediately before concrete is placed.
- C. Unless shown otherwise on drawings, corners of concrete members exposed to view after all other finish materials are in place shall be beveled by the use of chamfer strips (maximum ½-inch across the beveled face) placed in the forms. Submit sample for approval before proceeding.
- D. Overlap and hold forms against hardened concrete of a previous placement to prevent offsets or loss of mortar at the construction joint and to maintain a true surface.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Install inserts and materials to be cast into concrete.
- B. Set 1-inch deep 24-gage galvanized iron wall slots in all concrete surfaces adjacent to brick or block masonry. Slots shall be set vertical in concrete surfaces and spaced 16-inches on center horizontally. Provide masonry anchors spaced 16-inches on center vertically in each wall slot.
- C. Separate parallel runs of conduit by not less than 1-inch. Do not displace reinforcing bars from positions. No conduit shall be greater than ½ slab thickness. Bury conduit in slabs.
- D. Install Adjustable Wedge Inserts at 32-inches on center in concrete for shelf angles.

3.3 REMOVAL OF FORMS

- A. Horizontal member forms used to support the weight of concrete of structural members shall remain in place until the concrete has gained not less than 2/3 of the specified 28-day strength, or a minimum of 7 days.
- B. Vertical member forms and forms not supporting the weight of concrete shall not be removed in less than 24 hours.

END OF SECTION 031000

SECTION 032000 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit shop drawings for the fabrication and placing of reinforcing steel for approval, after being checked and approved by the contractor and before proceeding. Any changes by contractor or Fabricator of contract document details, materials, member sizes, or reinforcement shall be "flagged" on shop drawings accompanied by a written request for authorization and reason for requested change.
- B. Placing plans shall show all dimensions, details, notes, locations, sizes, lengths and each bar mark together with accessories and material belonging to the reinforcing for the concrete.
- C. Schedules shall show all information and be of the same form as those on the contract drawings.
- D. Concrete wall reinforcing shall be shown in elevation.
- E. Detail all reinforcing steel in accordance with the "ACI Detailing Manual", ACI Publication SP-66 (2004), unless otherwise indicated on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcement shall be fabricated from ASTM A615 "Deformed Billet-Steel Bars for Concrete Reinforcement", Grade 60.
- B. Reinforcement to be welded shall be fabricated from ASTM A706 "Low Alloy Steel Deformed Bars for Concrete, Grade 60.
- C. Welded smooth wire fabric (WWF) shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement", ASTM A185, and shall be fabricated from plain wire conforming to "Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement", ASTM A82.
- D. Wire bar supports shall conform to the National Bureau of Standards PS7, "Wire Bar Supports for Reinforced Concrete Construction".

2.2 FABRICATION

- A. All hooks shall be bent using the pin diameters and dimensions as "ACI Standard Hooks" in the "Manual of Standard Practice for Reinforced Concrete Construction", CRSI latest edition, unless otherwise shown on the plans.

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- B. Reinforcing bars shall not be bent or straightened in a manner that will injure the materials.
- C. Reinforcing bars shall conform to the dimensions shown on the plans and within the fabricating tolerances as shown in the "Manual of Standard Practices for Reinforced Concrete Construction", CRSI latest Edition.

PART 3 - EXECUTION

3.1 PLACEMENT/BAR REINFORCEMENT

- A. Bar reinforcement shall be placed in specified positions in the forms and held in place, before and during the placing of concrete by means of bar supports, to carry the reinforcing bars they support within the following tolerances from the positions shown on the drawings or specified herein:
 - 1. For clear concrete protection and for depth "d" in Flexural members, walls, and compression members where "d" is:
 - a. 8 inches or less – plus or minus 1/4"
 - b. More than 8 inches but less than 24 inches – plus or minus 1/2", but the cover shall not be reduced by more than one-half of the specified cover.
 - 2. For longitudinal location of bends and end of bars:
 - a. +2 inches except at discontinuous ends of member where tolerance shall be + 1/2 inch.
 - 3. For spacing
 - a. +2 inches except that total number of bars shall not be reduced.
- B. Except as shown otherwise on structural drawings, concrete cover for Reinforcing Bars shall be as follows:
 - 1. Cast against and permanently exposed to earth – 3 inches
 - 2. Exposed to earth or weather – 2 inches
 - 3. Interior formed surfaces:
 - a. Piers and Columns – 1/2 inch
 - b. Beams – 1/2 inch
 - c. Walls – 3/4 inch
 - d. Slabs & Joists – 3/4 inch
- C. "Continuous" bars, unless otherwise indicated on drawings, shall be lapped 36 diameters at splices. Provide corner bars to match primary reinforcing at all corner conditions, including continuous wall footings and grade beams.
- D. Splices not shown in contract documents shall be subject to approval.
- E. Support all reinforcing bars.
- F. Space bar supports a maximum of 4-feet on center with the first support not greater than 2-feet from the ends of the bars. Tie to prevent displacement during the concreting operations.

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Provide #4 support bars at 48-inches spacing where not supported by perpendicular reinforcement.

- G. Reinforcement shall not be "field" bent after being embedded in hardened concrete except where specifically shown on the drawings.
- H. Set and hold all vertical dowels in footings by template.

3.2 WELDING REINFORCEMENT

- A. The welding of reinforcing bars will be permitted only on approval on the shop drawings by the Architect.
- B. The welding of reinforcing bars at intersections for support purposes, in lieu of tie wire, is prohibited.
- C. The welding of reinforcing bars shall be performed in accordance with "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections for Reinforced Concrete Construction", AWS D 12.1-latest edition, as published by the American Welding Society.
- D. Welders shall be qualified by tests as prescribed in the "Standard Qualification Procedures, " AWS B 3.0-latest edition, as published by the American Welding Society.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RESPONSIBILITY AND QUALIFICATIONS

- A. Assume all responsibility for the work, design and engineering of the formwork and the safe support of property adjacent to the work.
- B. Work shall be done by one qualified to install the concrete work in accordance with the drawings and specifications. Minimum requirement for qualification shall be five years' experience with satisfactory completion of at least five similar projects.

1.2 SUBMITTALS

- A. Submit shop drawings for the fabrication and placing of reinforcing steel after being checked and approved by the Contractor and before proceeding. Submit no "Approved as Corrected" drawings for approval.
- B. Design and submit mix design series along with test data from laboratory or field experience (6 copies) corresponding to the same mix design. Concrete shall have 28 day compressive strength as indicated on the drawings.
- C. Test reports shall show the requirements of ASTM specifications.
- D. Shop Drawings shall be submitted in complete sets of a major area of work, with sheets consecutively numbered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: See Section 031000.
- B. Reinforcement: See Section 032000.
- C. Welded Fabric: See Section 032000.
- D. Bar Supports: Section 032000.
- E. Portland Cement: A domestic brand approved by the Architect for color and conforming to the requirements of ASTM C150, low alkali, Type I or Type III.
- F. Fine Aggregate: Conform to ASTM C33 except that the fineness modules shall not be less than 2.1 nor more than 3.1 and the gradation shall be as specified herein below:

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<u>Sieve No.</u>	3/8	#4	#8	#16	#30	#50	#100
Total % Passing (By Weight)	100	95-100	80-100	50-85	25-60	10-30	2-10

- G. Coarse Aggregate: Crushed stone or gravel and shall conform to ASTM C33. Size of coarse aggregate shall be as specified herein below:
1. Size #67: (3/4 inch to #4) – for Sections 4” thick and greater
 2. Size #7: (1/2 inch to #4) – for Sections less than 4” thick
- H. Water used in mixing concrete shall be clean and fit to drink.
- I. Admixtures:
1. Air-entraining Admixtures: Conform to the requirements of ASTM C260 and shall contain no chloride. Air-entraining shall not be used for interior slabs receiving troweled finishes. Submit certification for approval.
 2. Retarding Admixtures: Contain no chloride, shall be free of organic acids or salts of organic acids, shall be compatible with the air-entraining admixture to be used and shall conform to the requirements of ASTM C494, Type B. Submit certification for approval.
 3. Water-Reducing Admixtures: Contain no chloride, shall be free of organic acids, or salts of organic acids, shall be compatible with the air-entraining admixture to be used and shall conform to the requirements of ASTM C494, Type A, water-reducing normal-setting admixture and, ASTM C494, Type D, water-reducing and retarding admixture. Submit certification for approval.
 4. Water-Reducing, High Range (WRHR) Admixtures: Shall contain no chloride, shall be free of organic acids or salts of organic acids, shall be compatible with the air-entraining admixture to be used, and shall conform to the requirements of ASTM C494, Type F or G. Submit certification for approval.
 5. High, early strength accelerating, water-reducing admixture: contains no chloride, shall be free of organic acids, shall be compatible with air-entraining admixtures to be used and shall conform to the requirements of ASTM C494, Type C or F. Submit certification for approval
 6. Provide technical field service during initial pours at no cost to the Owner by one experienced in the adjustment of concrete mixes for the particular admixtures being used.
- J. Waterproof Curing Paper: Conform to ASTM C171
- K. Curing Compound: Contain no wax or varnish. Conform to ASTM C309, Type I, and Filor by West Chemical Products, Inc., Kure-N-Seal by Sonneborn-Contech, Inc., Clear Bond by Guardian Chemical Corp., Mr. Klear Seal by Castle Chemical Company, or Sealtight CS-309.
- L. Expansion Joint Material in the Building: Non-extruding and resilient non-bituminous type conforming to ASTM D1752, Type II.
- M. Dovetail Anchor Slots for Brick and Block Against Concrete: 1” x 1” 24 gage galvanized steel with drip type corrugated 16 gage galvanized steel anchors, Hohmann and Barnard, Inc., No. 305 with No. 303 anchor, Richmond Screw Anchor Co., Inc., No. 051F with 020 anchor, or Hackman Building Products No. 100 with No. 108 anchors.

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2.2 PROPORTIONING

- A. Proportion ingredients for each class of concrete by weight when the slump is the maximum permitted to produce an average compressive strength at 28 days which exceeds the specified compressive strength in accordance with Chapter 5, Section 5.3 of the Building Code Requirements for Reinforced Concrete (ACI-318-95).
- B. Air content of freshly mixed, air-entrained concrete as determined by the method of ASTM C 173 shall be 5%. A field tolerance of 1%+ is acceptable. All exterior concrete, exposed to the weather, shall be air entrained. Interior concrete shall not be air entrained.
- C. Water-reducing admixture shall be used in all concrete to reduce the total water requirement per cubic yard of concrete without loss of workability, and produce an increased strength proportional to the water/cement ratio. During ambient temperatures of 75 F or below use normal setting, water-reducing admixture meeting ASTM C484, Type A. During ambient temperatures of 75 F and above use set-retarding, water-reducing admixture meeting ASTM C494, Type B and Type D. During ambient temperatures of 60 F and below use a high, early strength accelerating water-reducing admixture meeting ASTM C494, Type C and Type E.
- D. The mixes shall be designed to secure concrete having the following consistency range in slump:

<u>Type of Construction</u>	<u>Slump Range (Inches)</u>
Reinforcement Foundations	2-3
Elevated, Structural Slabs	2-4
Sidewalks, Driveways & Slabs-on-Grade	2-4

2.3 BATCHING AND MIXING

- A. Measure cement by weight on a scale separate from those used for other materials. Cement may be measured in bags of standard weight of 94 pounds; however, no fraction of a bag shall be used in any batch.
- B. Measure aggregates by weight. Batch weights shall be based on saturated surface dry materials corrected for the actual moisture condition of the aggregate.
- C. Measure water by volume or by weight by devices not subject to variation due to variable pressure in the water supply line. Measuring tanks shall be provided with means for checking their calibration.
- D. Devices for measuring quantities of cement, aggregates, water and admixtures shall be accurate within 1% under operating condition.
- E. Furnish deliver ticket for each batch of concrete before unloading at the site. Weights of fine and coarse aggregate, amount of cement, and total water as batches shall be printed on ticket by an automatic printing device or shall be recorded and initialed by an employee of the Contractor stationed at the batch plant. Delivery ticket shall, in addition, include the following:

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1. Name of batch plant.
2. Serial number of ticket.
3. Date and truck number.
4. Name of contractor.
5. Job name and location.
6. Class of concrete and slump.
7. Cubic yards of concrete.
8. Time loaded.
9. Amount water added at job.
10. Initials of job superintendent.

- F. Ready-mixed concrete shall be produced and delivered in accordance with the requirements of ASTM C94.

PART 3 - EXECUTION

3.1 RESHORING

- A. Concrete elements shall not be permitted to deflect load during form stripping.
- B. After forms are removed, slabs, beams and girders over ten feet in span and cantilevers over four feet shall be reshored for the remainder of the 28-day period. Concrete elements shall not be permitted to deflect or accept load during reshoring operations.
- C. Reshoring operations shall be performed so that existing concrete members are not subject to overloads, eccentric loading, or reverse bending.
- D. Reshoring elements shall have the same capabilities as original shoring, and shall be wedged to provide solid bearing and support. Bracing shall be provided.

3.2 PLACING CONCRETE

- A. Give the Architect 48 hours advance notice before placing concrete in any portion of the structure to permit inspection of the forms and reinforcement. Embedded items of whatever nature shall be in place prior to inspection. An authorization of the Architect shall be secured before concrete is placed.
- B. Remove water and debris from forms before depositing concrete.
- C. Clean reinforcement and forms coated with foreign material or with concrete from previous placing operations before depositing concrete.
- D. Place concrete not later than 1-1/2 hours after mixing. Mix temperature shall not exceed 90 F at time of placing.
- E. Construction joints shall be keyed and bulkheaded vertically and located at the center of span.

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- F. Internal type mechanical vibrators and hand spading shall be used to consolidate the concrete.
- G. Concrete shall not be placed within twenty-five feet of workmen placing or securing reinforcement.
- H. Place no concrete when the atmospheric temperature is below 35 F. After concrete has been placed, if the temperature drops below 35 F, conform to paragraph 3.06, Curing and Protection.

3.3 FINISHING FORMED SURFACES

- A. Rough form finish shall be confined to all concrete surfaces not exposed to public view. After removal of forms, tie holes and defects shall be patched. Fins exceeding 1/4" in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imported by the forms.
- B. Smooth form finish shall be used for all concrete surfaces exposed to public view. Form facing material shall produce a smooth, hard, uniform texture on the concrete. Form material with raised grain, torn surfaces, worn edges, patches, or dents which will impair the textures of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be removed.

3.4 REPAIR OF DEFECTS

- A. Inspection by the Architect shall determine whether or not work is acceptable; and, if repairable, the method of repair to be used. Defects in materials and workmanship shall be subject to the above inspection at all times during the progress of the work regardless of previous inspections.
- B. Condemned work shall consist of any concrete work which cannot be repaired. Condemned work shall be removed and replaced, at the Contractor's expense, with work that will conform to the contract documents.
- C. Repair surface defects which are 1/2 inch or less in depth including tie holes by patching the same working day the forms are removed. Cut back defect at 90 degrees to the surface to sound concrete and at least 1" without feather edges. After soaking with water, pack a stiff mortar in the defect. In exposed concrete the mortar mix shall be determined by trial method using a mixture of white and grey portland cement to produce the described color. After mortar has attained its initial set, the patch shall be scraped or rubbed flush with the concrete and match the color and texture of the adjoining surface.

3.5 SLABS

- A. Edge forms and intermediate screed strips shall be set to produce the designated elevations and contours of the finished surface. As a minimum, maintain the concrete thicknesses shown on the drawings.
- B. Insure that termite treatment shall have been completed before installing vapor barrier. Install vapor barrier with 6" laps sealed with the manufacturer's recommended sealing compound.

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- C. Place and consolidate to produce a surface within tolerances. Test for grade (or level) and correct by removing excess or adding and compacting additional concrete. These operations must be performed before bleeding water has an opportunity to collect on the surface.
- D. Where metal forms are used at joints, the edge of the form shall be flush with the surface of the concrete. Where saw-cut joints are specified herein, cutting shall be started as soon as the concrete has hardened to prevent aggregates being dislodged by the saw, and shall be completed before shrinkage stresses become sufficient to produce cracking.
- E. Scratched finish shall be applied to surfaces intended to receive bonded applied cementitious applications. Depress slabs as specified for applied finish. All pitches to drains shall be made in the concrete slab and not the setting bed. Level to a Class C tolerance and roughen surface with stiff brushes or rakes before final set. Before the concrete has fully hardened remove laitance and loose aggregate from the surface.
- F. Troweled finish shall be applied to floors intended as walking surfaces or to receive contact floor coverings. Surface shall first be float-finished as specified above. It shall next be power troweled, and finally hand troweled. Final troweling shall be complete when a ringing sound is produced as the trowel is moved over the surface. The finished surface shall be free of trowel marks, uniform in texture and appearance, and shall be planed to a Class A tolerance, except tolerance for concrete on metal deck shall be Class B. Any defects of sufficient magnitude to show through floor covering shall be removed by grinding or patching.
- G. Tolerance for finish surfaces shall be determined by a straight edge placed anywhere on the surface in any direction and shall be true planes within the following limitations:
 - 1. Class A – 1/8 inch in 10 feet;
 - 2. Class B – 1/4 inch in 10 feet;
 - 3. Class C – 1/4 inch in 2 feet;

3.6 CURING AND PROTECTION

- A. Immediately after placement, concrete shall be protected from premature drying, temperatures above or below the range recommended in ACI 305R, latest edition, and 306R, latest edition, and mechanical injury.
- B. Cure all surfaces for a period of 7 days and until average compressive strength has reached 70% of specified strength. Curing shall be by ponding, moist curing with sand or absorptive mats kept continuously wet, continuous application of steam (not exceeding 105 F) or mist spray, waterproof curing paper or liquid membrane forming curing compound. Selection of curing method shall be compatible with the finish to be applied to the concrete surface.
- C. Use curing compound directly from the container without dilution and apply not later than one hour after final finishing in one coat at a coverage not to exceed 200 S.F. per gallon for surfaces with a "floated" or "broom" finish, or 300 S.F. per gallon for surfaces with a "troweled" finish. Submit engineering testing laboratory certification for approval. Do not use curing compound on surfaces to receive mortar beds for tile work.

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- D. Cold weather protection shall be in accordance with recommended practices of ACI 306R, latest edition. Whenever the mean daily outdoor temperature is less than 40 F, the temperature of the concrete shall be maintained between 50 F and 70 F for the curing period.
- E. Hot weather protection shall be in accordance with ACI 305R, latest edition. When the anticipated ambient air temperature exceeds 80 F during placing or finishing operations, a retarding admixture shall be used in the mix to retard the setting time of the concrete.

3.7

- A. Contractor shall submit to the Architect the concrete materials and the concrete mix designs proposed for use with a written request for review. Submittal shall include the results of all testing performed to qualify the materials and to establish the mix designs. Place no concrete in the work until mix design has been reviewed.
- B. Contractor shall sample, mould, initially cure, and transport to the laboratory the acceptance test specimens for testing. During the first 24 hours after molding he shall provide means for maintaining the temperature immediately adjacent to the specimens within the range of 60 F to 80 F and prevent loss of moisture from the specimens. After the initial curing period the acceptance test specimens shall be transported in a damp condition to the laboratory in a manner to prevent damage to the specimens. Include information for reporting of test data.
 - 1. Slump and air content shall be determined at the beginning of each day's pour and for each batch of concrete sampled for compressive strength tests. Make corrections to the mix if slump, unit weight, or air content are not within the specified tolerances. Slump and air content shall be determined by ASTM C143 and ASTM C173 respectively.
 - 2. Make sets of four acceptance cylinders for strength testing for each 50 yards of concrete or fraction thereof for each class and strength for each day's concreting which shall be molded from concrete samples taken at random over the duration of the pour.
 - 3. Samples of concrete for strength testing shall be representative of the concrete in-place in the structure and shall not be taken from the first one-third of the concrete of the ready-mix truck. **No water shall be added to the concrete after samples of concrete for strength testing have been secured.**
 - 4. Acceptance test cylinders shall be molded and cured in accordance with ASTM C31 from concrete samples in accordance with ASTM C172
 - 5. Provide designated testing laboratory with all field data specified to be included on concrete test reports in paragraph 3.08.
 - 6. Field sampling and testing shall be performed by ACI Certified Technicians.

3.8 LABORATORY DUTIES IN TESTING

- A. Designated testing laboratory shall perform all operations of testing materials, concrete and verifying mix designs.
- B. Concrete test reports shall include the following:
 - 1. Class and strength concrete.
 - 2. Slump.

3. Air content.
 4. Temperature of concrete mix at time of placement.
 5. Date and time of molding.
 6. Date and age of test specimens.
 7. Location of concrete in the structure.
 8. Delivery ticket serial numbers.
- C. Furnish all test reports to the Architect.
- D. Designated testing laboratory shall be selected by the Architect and paid by the Owner.

3.9 STRENGTH TESTING AND EVALUATION

- A. For each set of acceptance test cylinders, one cylinder shall be broken at the age of 7 days for information and two cylinders shall be broken at the age of 28 days for acceptance. The remaining cylinder shall be held by the laboratory for 120 days for use as a verification cylinder if required. Test in accordance with ASTM C39, latest edition.
- B. Concrete shall be considered "Questionable Concrete" where any of the following test evaluations occur:
1. Individual test strength is more than 500 psi below specified strength; or
 2. Average of any three consecutive strength tests are less than specified strength; or
 3. Individual test strength is less than specified strength and the concrete represented by the test is for concrete for a "critical" area of the structure. Critical areas of the structure are those areas which, in the opinion of the Architect, are critical to the structural stability of the structure as a whole.

3.10 QUESTIONABLE CONCRETE

- A. Core tests shall be made at no cost to the government, and as directed by the Architect. If core tests fail to demonstrate the test strength required by the contract documents, or if they are impractical to obtain, and structural analysis does not confirm the safety of the structure, the Architect may, at his discretion, condemn the work or require load tests or additional construction. Should structural analysis confirm the safety of the structure, the Architect may, at his discretion, accept the questionable concrete in accordance with the Article of the General Conditions for the Acceptance of Defective Non-Conforming Work.
- B. The Contractor shall pay all costs incurred in providing the additional testing or analysis to resolve the acceptability of questionable concrete.
- C. The term "Building Official" in ACI Building Code 318 shall be deemed to mean, and does mean, the Architect.

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3.11 CORE TESTS

- A. Three representative cores shall be taken from each member or area of concrete for each test considered "questionable". Location of cores shall be as directed by the Architect to least impair the strength of the structure. Damaged cores shall be replaced.
- B. Cores shall be obtained and tested in accordance with ASTM C42, latest edition except that if concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 F to 80 F, and relative humidity less than 60%) for 7 days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.
- C. Concrete in the questionable area will be considered structurally acceptable if the average of the cores is equal to or greater than 90% of the specified strength and no single core is more than 500 psi below specified strength.

3.12 LOAD TESTS AND ADDITIONAL CONSTRUCTION

- A. Load tests shall be applied and their results evaluated in accordance with Chapter 20 of ACI Building Code 318, latest edition.
- B. Work judged inadequate by results of a load test shall be reinforced with additional construction if so directed by the Architect or shall be replaced.
- C. Additional construction and replaced work shall be at the Contractor's expense.

3.13 CONDUIT WORK

- A. Electrical conduits shall be buried in concrete slabs. Low conduit shall be wired to the upper side of bottom reinforcing and top conduit shall be wired to the lower side of top steel.
- B. Take care in spacing concrete around gangs or parallel conduit. Where such conduits occur, they shall be separated by at least one inch.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strength of masonry of (f'_M) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Table 1 and Table 2 in ACI 530.1/ASCE 6/TMS 602.
- B. Concrete Masonry Units: $f'_M = 1,500$ psi

1.2 HANDLING AND STORAGE

- A. Handle concrete masonry units to prevent chipping and breakage, and store on platforms to protect them from contact with the soil. Cover stored brick and block with waterproof coverings.
- B. Deliver, store and handle mortar materials to prevent deterioration, inclusion of foreign materials, damage of materials by water, or breakage. Packages or materials showing evidence of water or damage shall be rejected.
- C. Any material damaged in any way shall not be used for masonry work. Cement and lime shall be delivered and stored in the original, unbroken containers, marked as to manufacturer and brand.

1.3 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Where indicated on the drawings, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119-88 by a recognized testing and inspecting organization.
- B. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product specified herein for each continuous surface or visually related surfaces.
- C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- D. Field Constructed Mock-Ups: Prior to installation of masonry work, erect sample wall panels in a location approved by the Architect to represent completed masonry work for qualities of

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appearance, materials and construction; build mock-ups to comply with the following requirements:

1. Build mock-ups for exterior wall 6' long by 4' high by full thickness, including face and back-up wythes as well as accessories.
2. Retain mock-ups during construction as standard for judging completed masonry work. When directed by the Architect, demolish mock-ups and remove from site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Masonry Units: Conform to ASTM C90-85, Type N-II. Hollow lightweight, concrete masonry units of modular dimensions of size and shapes necessary to complete the work. Units shall be sound and free from cracks, chipped edges, and defects which would interfere with their setting or impair the strength or durability of the construction. Exposed Faces: Manufacturer's standard color and texture.
- B. Water: Clean and potable.
- C. Portland Cement: Conform to ASTM C150-89, Type II. Cement used throughout the project shall not vary in color.
- D. Masonry Cement: Conforms to ASTM C91-89, Type M or S.
- E. Sand for Masonry Work: Conform to ASTM C144-87, of color matching approved sample.
- F. Joint Reinforcement: Have 8 gauge side bars conforming to ASTM A82-88 and 9 gauge cross bars, formed to truss design, with side bars and cross bars galvanized. Reinforcement shall be of width to extend to within 1" of the faces of the walls equal to Dur-O-Eye with 3/16" diameter Dur-O-Wall adjustable wall tie eye sections welded at 16" centers.
- G. Wall Ties for Brick: Rectangular adjustable wall ties mated to CMU eye sections and provisions for securing reinforcing bar in brick (Seismic reinforcing).
- H. Wire Mesh Ties: Galvanized hardware cloth, 19 gauge, 1/2" mesh, 3" minimum width.
- I. Miscellaneous Masonry Accessories
 1. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated on the drawings. Styrene-butadiene rubber compound.
- J. Masonry Grout: Use grout conforming to ASTM C476 and the Structural Notes on Sheet S0.1 of the structural drawings.
- K. Vertical reinforcement: See Section 032000.

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L. Reinforcing Bar Positioners

1. Horizontal Bars: Dur-O-Wal D/A 811 or equal; nine gauge basic bright finish steel wire meeting ASTM A82-01.
2. Vertical Bars: Dur-O-Wal D/A 810 or equal; nine gauge basic bright finish steel wire meeting ASTM A82-01.

2.2 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures including coloring pigments, air entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds or admixtures, unless otherwise indicated on the drawings. Do not use calcium chloride in mortar or grout.
- B. Mortar Color: Mortar shall be colored to match colors on existing build-up.
- C. Mixing: Combine and mix cementitious materials, water, and aggregates in mechanical batch mixer; comply with referenced ASTM standards for mixing times and water content.
- D. Mortar for Unit Masonry: Comply with ASTM C 270-88a, Proportion Specification, for types of mortar specified, unless otherwise indicated on the drawings.
 1. Use Type M mortar for masonry below grade and in contact with earth, and where indicated on the drawings.
 2. Use Type M or S mortar for load bearing exterior and interior load bearing walls.
- E. Grout for Unit Masonry: Use concrete grout as indicated on structural drawings.
 1. The quantities of cementitious materials shall be adjusted to maintain the specified strength.

2.3 MIXING MORTARS

- A. Mortars shall be machine mixed in mixer in which water quantity can be controlled. For work requiring only small mortar or grout batches, mortar may be hand mixed.
- B. Mixing time shall be at least 5 minutes, 2 minutes which shall be devoted to mixing dry materials and 3 minutes for continuing mixing after addition of water. Use no mortars that have stood more than one and one-half hours.
- C. Where dry mix method is used, rake wall; turn over materials for each batch before adding water until even color of mixed materials indicates that cementitious material has been distributed throughout mass, after which add water in increments until mixed mortar of workable plasticity is obtained.
- D. Pointing mortar shall be of dry consistency as will produce mortar sufficiently plastic to be worked into masonry joints.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Work of other trades shall be installed and tested before enclosing such work with masonry.
- B. Build-in horizontal masonry reinforcement at 8" on center vertically below grade and 16" on center vertically above grade. Joint reinforcement shall be continuous, lapped not less than 6" at splices, with corners cut and bent to insure continuity. Joint reinforcement shall not pass through vertical control joints. At corners where joint reinforcement does not occur in the same course in two abutting walls, carry joint reinforcement from each wall around the corner not less than three feet into abutting wall.
- C. Examine drawings to determine requirements for accommodation of work of other trades and provide recesses, chases, reglets, slots for such work; patch around same.
- D. In cold weather, when the outside temperature is below 40F, the temperature of the masonry when laid shall be above 40F and maintained on both sides of the masonry wall for at least 72 hours.
- E. Make provisions to prevent damage from wind.
- F. Keep masonry dry until capped by construction details. Cover tops of all walls and other masonry when stopping work for the day and protect them at all times from rain with weighted canvas of 6 mil polyethylene film covers.
- G. Provide cutting and patching to accomplish the indicated work and to accommodate the work for others. Patching shall match adjoining work in pattern and texture. Masonry saws shall be used for cutting masonry units.

3.2 BLOCK MASONRY

- A. Concrete masonry units shall be of sizes shown on the drawings, laid up plumb and true to line, and with cells vertical. Interior exposed concrete masonry units shall be laid up in running bond.
- B. The first course of block shall be laid on a full bed of mortar after the concrete slab has been cleaned and dampened. Except at cells containing reinforcing rods, fill cells of the first course solid with mortar.
- C. Work shall be anchored and bonded as specified above.
- D. The vertical mortar joint at wall intersections shall be raked out to a depth of 1" on both faces, caulked per Section 079200 – Joint Sealants
- E. Voids in concrete masonry units containing reinforcing rods, and at locations shown on the drawings, shall be filled with 3,000 psi grout as indicated on structural drawings.
- F. One block and one join shall equal 8".

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- G. Joints shall be of uniform thickness, and where exposed shall be flush.
- H. Build rated walls per UL U905.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.
- B. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
- C. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".
- D. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.4 LAYING MASONRY WALLS

- A. Layout walls in advance for specified spacing of surface bond patterns with uniform joint widths and to locate openings, movement-type joints, returns and offsets. Do not use less-than-half-size units at corners, jambs and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses spaced and coordinated with other work.
- C. Stopping and Resuming Work: Rack back 1/2-unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly and remove loose masonry units and mortar prior to laying fresh masonry.
- D. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in with masonry around built-in items.
 - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 2. Where build-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
 - 3. Fill cores in hollow concrete masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated on drawings.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- B. Maintain joint widths shown, except for minor variations to maintain bond alignment. If not shown, lay walls with 3/8" joints.
- C. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
- D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. For adjustments, remove units, clean off mortar and reset in fresh mortar.

3.6 VERTICAL REINFORCING

- A. All vertical reinforcing shall be installed at the centerline of the wall (or at the locations indicated) with a tolerance of plus or minus 1/2 inch lateral to the wall centerline.
- B. **Reinforcing Bar positioners shall be used for all vertical reinforcing.**
 - 1. Provide two per 5 foot lift but not less than two per each length of spliced reinforcing bar.
 - 2. Horizontal Type: Install in accordance with ACI Committee 530 Code Recommendations.
 - 3. Vertical Type: Install U-block or lintel block in accordance with Code requirements.

3.7 GROUTING

- A. All grouting of masonry shall be installed in five foot lifts with each lift being grouted before laying masonry units for next lift.
- B. Grouted masonry shall be constructed in such a manner that all elements of the masonry act together as a structural element.
- C. Prior to grouting, the grout space shall be clean so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings or other foreign material. Grout shall be placed so that all spaces designated to be grouted shall be filled with grout and the grout shall be confined to those specific spaces.
- D. Grout materials and water content shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly.

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- E. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.
- F. Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of 1½ inches below a mortar joint, except at top of wall. Where bond beams occur, stop grout pour a minimum of 1/2 inch below the top of the masonry.
- G. All cells and spaces containing reinforcing bars shall be filled with grout. Otherwise, grout masonry indicated on drawings.

3.8 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement in alternate courses of each wythe of all concrete masonry, including 4" veneer. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6".
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated on drawings.
- C. Reinforce each wythe of all walls with continuous horizontal joint reinforcing unless noted to be omitted on drawings.
- D. Provide continuity at corners by use of prefabricated "L" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions. Space continuous horizontal reinforcement.
- E. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in 2 horizontal joints 8" apart, above the lintel and below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. In load bearing wall, provide additional reinforcing as indicated on the structural drawings.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown on the drawings. Build-in related items as the masonry work progresses.
- B. Build-in non-metallic joint fillers where indicated on the drawings.

3.10 LINTELS

- A. Install steel and masonry lintels where indicated and as scheduled on the drawings.
- B. Provide masonry lintels where shown in the drawings, and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide formed-in-place masonry lintels. Support formed-in-place lintels. For

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hollow concrete masonry unit walls, use formed U-shaped lintel units with reinforcement bars placed as shown on the drawings, filled with coarse grout.

- C. Provide minimum bearing of 8” at each jamb, unless otherwise indicated on drawings.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and fill with mortar. Point-up all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants.
- C. 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 non-metallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean standard concrete unit masonry to comply with masonry manufacturer’s directions and applicable NCMA “Tek” bulletins.
- D. Protection: Provide final protection and maintain conditions in the manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of Final Certificate of the Architect.

END OF SECTION 042200

SECTION 050553 – TAMPER PROOF METAL FASTENERS

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. Tamper proof metal fasteners.
 - 2. Accessories.

- B. Related Requirements:

- 1. Division 05 for Metals
 - 2. Division 08 for Openings
 - 3. Division 09 for Finishes
 - 4. Division 10 for Specialties
 - 5. Division 11 for Equipment
 - 6. Division 12 for Furnishings
 - 7. Division 13 for Special Construction
 - 8. Division 21 for Fire Suppression
 - 9. Division 22 for Plumbing
 - 10. Division 23 for Heating, Ventilating, and Air-Conditioning (HVAC)
 - 11. Division 26 for Electrical
 - 12. Division 27 for Communications
 - 13. Division 28 for Electronic Safety and Security

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle per manufacturer's requirements.

PART 2 - PRODUCT

2.1 SOURCES

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A. Security Screws may be obtained through the following dealers:

1. Bryce Fastener Company, Inc.; Gilbert, AZ
2. Camcar Division of Textron, Inc.; Rockford, IL
3. Safety Socket Screw Corporation; Chicago, IL
4. Sentry Security Fasteners, Inc.; Peoria, IL
5. Tamper-Pruf Screws, Inc.; Paramount, CA
6. Tanner Bolt & Nut Corporation; Brooklyn, NY

2.2 TAMPER PROOF METAL FASTENERS

A. Exposed Security Fasteners:

1. Torx-head (star design with center pin) security fasteners.
2. Finish shall match that specified of the item anchored.

B. Expansion Anchors:

1. Structural concrete or masonry stud anchors similar to Hilti Qwik-Bolt or equal.
2. Provide with non-removable nuts or twist-off nuts.

C. Fabrication:

1. Fabricate removable tamper proof fasteners to allow removal only by tools produced by fastener manufacturer or other licensed fabricator specifically for individual tamper proof fastener design.
2. Plating: Cadmium, zinc, nickel, phosphate and chrome to match adjacent materials.
3. Limit size and shape variations such that no more than six (6) different tools are required for each type of tamper proof fastener used on project.

2.3 ACCESSORIES

A. Screw-thread Adhesive Sealant:

1. Products:
 - a. Loctite No. 271
 - b. Permatex Permanent Strength Threadlock Red
 - c. J-B Weld 27113 Perma-Lock Threadlocker

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Provide tamper proof metal fasteners to work under the General, Mechanical, and Electrical Contracts. This shall include fasteners for equipment, furnishings, fixtures, doors, windows, exposed structural connections, attachments and hardware.

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- B. Tamper proof metal fasteners shall be used for fastenings, except in the following areas:
 - 1. Administration and Staff areas.
 - 2. Mechanical and electrical rooms.
 - 3. Areas above suspended ceilings, behind access panels and within pipe and duct chases.

3.2 INSTALLATION

- A. Install work using proper sized tamper proof fastener, matched to configuration, structural loading, and size.
- B. Install fasteners with the proper amount of torque as recommended by the manufacturer.
- C. Set tamper proof fasteners with screw thread adhesive sealant in accordance with manufacturer's instructions.
- D. Store and maintain inventory control for each installing tool used for installation of security fasteners. After use, installers shall return tools for inventory control. At completion of the project, installing tools shall be turned over to the facility.

3.3 SPARE PARTS

- A. Provide five (5) security fastener kits to the Owner. Kits shall contain all fasteners found on project and a tool with bits.

END OF SECTION 050553

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section includes fabrication and erection of structural steel indicated in the Contract Documents or otherwise required for proper completion of the work.

1.2 REFERENCES

- A. AISC – Code of Standard Practice for Steel Buildings and Bridges
- B. AISC – Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
- C. AISC – Specifications of Structural Joints using ASTM A325 or A490 bolts approved by the Research Council in Structural Connections.
- D. AWS D1.1 – Structural Welding Code.
- E. AWS A5.1 – Specification for Carbon Steel Electrodes for Shield Metal Arc Welding.
- F. AWS A5.5 – Specification for Low-Alloy Steel Covered Arc Welding Electrodes.
- G. AWS A5.17 – Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
- H. AWS A5.20 – Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
- I. SSPC – Steel Structures Painting Manual.
- J. ASTM A36 – Standard Specification for Structural Steel.
- K. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
- L. ASTM A108 – Standard Specification for Steel Bar, Carbon and Allow, Cold-Finished, Standard Quality.
- M. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- N. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- O. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

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- P. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- Q. ASTM A325 – Standard Specification for Structural Bolts, Heat Treated, 120/105 KSI Minimum Tensile Strength.
- R. ASTM A490 – Standard Specification for Heat-Treated Steel Structural Bolts, 150 KSI Minimum Tensile Strength.
- S. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Tubing in Rounds and Shapes.
- T. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- U. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
- V. ASTM A992 – Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- W. ASTM F436 – Standard Specification for Hardened Steel Washers.
- X. ASTM F844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
- Y. ASTM A6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
- Z. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- AA. ASTM A673 – Standard Specification for Sampling Procedure for Impact Testing of Structural Steel.
- BB. ANSI/AISC 341-02 – Seismic Provisions for Structural Steel Buildings.

1.3 SUBMITTALS

- A. Contact Structural Engineer's Construction Administration Division prior to detailing structural steel shop drawings.
- B. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files may be provided to the Contractor at the engineer's discretion.
- C. Submit shop drawings for review.
- D. Shop drawings shall clearly indicate the profiles, sizes, ASTM Grade, spacings and locations of all structural steel members, including connections, attachments, anchorage's, framed openings,

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sizes and types of fasteners, method of tightening fasteners, cambers, and the number, type and spacing of the headed shear connectors.

- E. For record only, submit written Welding Procedure Specifications (WPS) for each type of welded joint used in accordance with AWS D1.1.
- F. Maintain at construction office mill certification that the steel supplied meets the specifications.
- G. Maintain at construction office certification that high strength bolts supplied meet the specifications.
- H. Submit certification that the fabricator meets the required qualifications and ultrasonic testing reports for complete penetration welds. If fabricator has to have an independent testing agency to inspect fabrication as required by these specifications, submit the name and qualifications of the independent testing agency.
- I. Submit certification that the erector meets the required qualifications.
- J. Upon request, submit the erection sequence and procedures to be used by the steel erector.
- K. Upon request, submit shop measurements for camber.

1.4 QUALITY ASSURANCE

A. Headed Studs

- 1. Inspection and testing shall be in accordance with AWS D1.1
- 2. The inspector shall verify the pre-production testing in accordance with Section 7.7.1 of AWS D1.1.
- 3. The inspector shall perform periodic inspection of all headed stud welding.
- 4. Bend tests shall be conducted as required by Section 7.8.1 of AWS D1.1. In addition; a minimum of 5% of all headed studs shall be subjected to bend tests. Retest all studs on any member that has a stud failing the bend test.

1.5 FABRICATOR'S QUALIFICATIONS

- A. Steel fabricator shall be certified by the American Institute of Steel Construction (AISC) Quality Certification Program for Conventional Steel Buildings (Sbd) and, if required by the Building Code, approved by the Building Official. In addition, fabricator shall ultrasonically inspect 100% of the complete penetration welds performed in the shop.
- B. Fabricator not certified by the AISC Quality Certification Program shall have fabrication procedures and fabricated steel tested and inspected by an independent testing agency. Payment of these tests and inspections shall be by the fabricator. Tests and inspections shall be performed by AWS Certified Welding Inspectors. Prior to delivery of structural steel to the project, submit

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copies of the inspection reports to the Structural Engineer. The purpose of this inspection is to enable the testing/inspection agency to verify that, in general, the steel is being fabricated in accordance with the Contract Documents. A minimum of one trip per week is recommended. The first trip should be scheduled in the early stages of fabrication. Contact Structural Engineer prior to initial inspection. Tests and inspections shall include the following:

1. Examine mill test reports and verify that material being used is the same as the mill test reports.
2. Review the fabricator's written welding procedures. Verify that the fabricator's welding procedures are being followed. Verify that welders are certified with current papers and that they demonstrate proper techniques.
3. Observe high strength bolting procedures. Verify that shop installation of high strength bolts conform to AISC specifications.
4. Camber
 - a. Measure 25% of all cambered steel members (in field) prior to erection for compliance with the AISC Code of Standard Practice. Camber shall be checked at mid-point of member length.
5. Examine joint preparation for complete penetration joints. Ultrasonically inspect 100% of the complete penetration welds performed in the shop.
6. Examine fillet welds for proper size, profile, throat, porosity and end returns.
7. Examine steel members for lamellar tearing. Spot check dimensions and hole sizes.
8. Examine bolted areas for burrs.

1.6 ERECTOR'S QUALIFICATION

- A. Erector shall be experienced in erecting structural systems similar in complexity to this project as evidenced by 10 completed projects.
- B. Erector shall have a minimum of 5 years experience in the erection of structural steel or is an AISC Certified Advanced Steel Erector.

1.7 STORAGE

- A. Store materials off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 - PRODUCTS

2.1 ANCHOR RODS

- A. Anchor rods shall be threaded rods conforming to ASTM F1554 Gr. 36 unless noted otherwise on the drawings. The anchor rods shall be threaded at both ends.
- B. Provide a heavy hexagonal nut threaded and tack welded to the bottom of each rod unless noted otherwise on the structural documents. The nut shall conform to ASTM F844.
- C. Provide two hexagonal nuts and two plain steel washers at the top of each rod. The nuts and washers shall conform to ASTM F844.
- D. Provide 3/8 inch thick plate washers with standard holes in lieu of top steel washers on base plates with oversized holes. Oversized holes are defined as any hole that is larger than a standard hole as defined in Chapter J of the AISC Specification. Recommended base plate holes as given in the AISC Manual are considered oversized holes. The plate washer shall be square and shall be a minimum size of 3/4 inch + the actual hole diameter. Plate washers shall be sized as required to provide a minimum 3/8 inch lap over hole in base plate, but minimum of 3 inch x 3 inch and shall be centered over the hole.

2.2 ROLLED STEEL SHAPES, PLATES, AND BARS

- A. Rolled steel W shapes shall conform to ASTM A992, 50 ksi minimum yield strength, unless noted otherwise on the contract drawings.

ASTM A572, Grade 50 may be substituted for ASTM A992
- B. Rolled steel M, S, C, MC, and L shapes shall conform to ASTM A36, 36 ksi minimum yield strength, unless noted otherwise on the contract drawings.
- C. Plates and Bars shall conform to ASTM A36, 36 ksi minimum yield strength, unless noted otherwise on the contract drawings.

2.3 SQUARE/RECTANGULAR HOLLOW STRUCTURAL STEEL SECTIONS

- A. Square/rectangular hollow structural steel sections shall conform to ASTM A500, Grade B, 46 ksi minimum yield strength.

2.4 ROUND HOLLOW STEEL PIPE

- A. Round hollow steel pipe shall conform to ASTM A53, Grade B, 35 ksi minimum yield strength.

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2.5 NON-HIGH-STRENGTH FASTENERS

- A. Non-high-strength bolts shall conform to ASTM A307, Grade A, 60 ksi minimum, where noted on the Structural Drawings.
- B. Hardened steel washers shall conform to ASTM F436.

2.6 HIGH-STRENGTH FASTENERS

- A. High-strength bolts shall conform to ASTM A325 or ASTM A490 as noted on the Structural Drawings.
- B. Provide 3/4 inch minimum diameter bolts, unless noted otherwise.
- C. Hardened steel washers shall conform to ASTM F436.
- D. Spline-type tension control bolts, plain hardened washers and suitable nuts are an acceptable alternate design bolt assembly.
- E. Do not use load indicating washers.

2.7 HEADED STUDS

- A. Headed steel studs shall conform to the requirements of AWS D1.1
- B. Provide 3/4-inch diameter headed steel studs, unless noted otherwise.
- C. Provide heat-resistant ceramic arc shields with studs.

2.8 ROUND RODS

- A. Rods shall conform to ASTM, A36
- B. The rods shall be threaded at each end. The rods shall be smooth for the entire length.

2.9 FORGED STEEL HARDWARE ITEMS

- A. Structural hardware items such as clevises, turnbuckles, sleeve nuts, recessed-pin nuts, and cotter pins shall comply with the dimensions, weights, and design strengths as set forth in tables 15-4 through 15-8 (as applicable) in the AISC Manual of Steel Construction, LRFD, Third edition.
- B. Material shall comply with SAE C-1035, C 1030, or other steel alloy approved equal.

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2.10 EXPANSION ANCHORS

- A. Expansion anchors shall be Hilti HSL-3 Heavy Duty Expansion Sleeve Anchors supplied by Hilti Fastening Systems, the Hilti HDA Undercut Anchors supplied by Hilti Fastening Systems, or the Strong Bolt Anchors supplied by Simpson Strong-Tie Co. or approved alternate

2.11 ADHESIVE ANCHORS

- A. Adhesive anchors shall consist of:
 - 1. An all-thread steel anchor conforming to ASTM A307, Grade A or ASTM A36, zinc plated in accordance with ASTM B633, unless noted otherwise on the Structural Drawings, and
 - 2. An adhesive conforming to HIT HY150 injection adhesive (HIT HY20 adhesive for masonry construction with voids) supplied by Hilti Fastening Systems, EPCON System Ceramic 6 epoxy adhesive supplied by ITW Ramset/Red Head, Power-Fast epoxy injection gel supplied by Powers Fastening, Acrylic-Tie adhesive supplied by Simpson Strong-Tie Co., or approved equal.

2.12 WELD ELECTRODES

- A. E-70 series low hydrogen electrodes shall conform to AWS A5.1, A5.5, A5.17, or A5.20.
- B. Properly store electrodes to maintain flux quality.

2.13 PRIMER

- A. Oxide primer shall conform to AISC Specifications, Code of Standard Practice, and SSPC Steel Structure Painting Manual, unless indicated otherwise.
- B. Paint primer shall be free of lead and chromate and shall comply with State and Federal volatile organic compound (VOC) requirements.
- C. Paint primer shall be compatible with finish coating.

2.14 GALVANIZING

- A. Galvanized coating shall conform to ASTM A123.
- B. Galvanize bolts, nuts, and washers in accordance with ASTM A153 when used to connect steel members that are specified to be galvanized.
- C. Expansion anchors or adhesive anchors specified to be galvanized shall be mechanically galvanized in accordance with ASTM B695, Class 65, Type I.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fabricate and erect structural steel in accordance with AISC Specifications and Code of Standard Practice.
- B. Notify Architect/Structural Engineer and Structural Testing/Inspection Agency at least 48 hours prior to structural steel fabrication and erection.

3.2 ANCHOR BOLT (ROD) SETTING

- A. Provide templates for setting anchor bolts (rods). Position anchor bolts (rods) by using templates with two nuts to secure in place prior to placement of concrete.
- B. Do not erect steel where anchor bolt (rod) nuts will not have full threads.

3.3 CONNECTIONS

- A. Provide a minimum of two fasteners at each bolted connection.
- B. Ensure fasteners are lubricated prior to installation.
- C. Provide high-strength bolted connections in accordance with AISC Specifications for Structural Joints using ASTM A325 or A490 Bolts.
- D. Provide connections for expansion and contraction where steel beams connect to concrete walls or concrete columns and at expansion joints. Secure nuts on bolts against loosening. (Dent threads with a chisel.)

3.4 FASTENER INSTALLATION

- A. Bolts shall be installed in holes of the connection and brought to snug tight condition. Tighten connection progressing systematically from the most rigid part to the free edges of the connection to minimize relaxation of the bolts.
- B. High-strength bolts installed shall have a hardened washer under the element turned in tightening.
- C. Installation and tightening of bolts shall conform to the AISC Specifications for Structural Joints.

3.5 HEADED STUDS

- A. Headed studs shall be welded in accordance with AWS D1.1.

- B. Remove shields after welding studs.

3.6 EXPANSION ANCHOR INSTALLATION

- A. Install in accordance with manufacturer's recommendation.
- B. Minimum embedment shall be equal to 6 times the anchor diameter unless noted otherwise.

3.7 ADHESIVE ANCHOR INSTALLATION

- A. Install in accordance with manufacturer's recommendation.
- B. Minimum embedment shall be equal to 9 times the anchor diameter unless noted otherwise.

3.8 WELDING

- A. Comply with AWS Structural Welding Code. Use prequalified weld procedures.
- B. Provide end returns where fillet welds terminate at end or sides. Returns shall be continuous for a distance of not less than two times
- C. Complete penetration joints shall be back gouged to sound metal before the second side is welded or have 1/4 inch root opening with 3/16 x 1 inch backing bar. Access holes are required. Filling access holes is not required.
- D. Remove all slag and weld splatter from deposited weld metal.
- E. Weld access holes shall be as shown on the structural drawings. The weld access hole shall be ground smooth to a surface roughness value not to exceed 500 micro in., and shall be free of notches and gouges. Notches and gouges shall be repaired.

3.9 SPLICING

- A. Splice members only where indicated unless authorized in writing by Structural Engineer.
- B. Provide shim plates at bottom flange splice at continuous beam splices with different depths.

3.10 CUTTING

- A. Do not use flame cutting to correct errors unless authorized in writing.
- B. Re-entrant corners shall have a minimum radius of one inch and be free of notches. Notches and gouges resulting from flame cutting shall be finished to a smooth appearance.

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3.11 MILL SCALE

- A. Remove loose mill scale.

3.12 BOLT HOLES

- A. Cut, drill, or punch holes perpendicular to metal surfaces. Do not enlarge holes by burning. Drill or punch holes in bearing plates. Remove burrs.

3.13 PRIMING STEEL

- A. Prime steel that is not encased in concrete, plaster, or sprayed fireproofing. Do not shop prime in areas to be field welded, contact surfaces of slip critical connections, or areas to receive special finishes.
- B. Field prime, as required, steel that has been welded or that is not primed after connections have been tightened.
- C. Verify primer requirements with Architect for building without fireproofing.

3.14 GALVANIZING

- A. Galvanize shelf angles that support the exterior building veneer, for example brick shelf angles.
- B. Galvanize environmentally exposed steel; for example, mechanical equipment supports.
- C. Touch-up welds and abrasions in galvanized members in accordance with ASTM A780.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section includes steel decking as indicated on Drawings, specified herein, and needed for complete and proper installation.

1.2 RELATED SECTIONS

- A. Section 013300 – Structural Submittals.
- B. Section 014200 – Structural Testing/Inspection Agency Services.
- C. Section 051000 – Structural Steel.

1.3 REFERENCES

- A. AISI – Specifications for the Design of Cold-Formed Steel Structural Members.
- B. AWS D1.1 – Structural Welding Code.
- C. AWS A5.5 – Specifications For Low Alloy Steel Covered Arc-Welding.
- D. SDI – Basic Design Specifications.
- E. SDI – Steel Roof Deck Design Manual.
- F. ASTM A653 / A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A924 / A924M – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- H. ASTM A1008 / A1008M – Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy and High Strength Low Alloy with Improved Formability.

1.4 SUBMITTALS

- A. Notify the Structural Engineer prior to detailing shop drawings.
- B. Submit detailed shop drawings showing layout and types of deck panels, weld sizes, weld patterns and conditions requiring closure panels, supplementary framing, sump pans, cant strips,

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cut openings, special jointing or other accessories. Include calculations and required information if not completely covered by load tables and products data.

- C. Upon request, submit mill certification that the steel supplied meets the required specifications.
- D. Upon request, submit written welding procedures.
- E. Submit manufacturer's specifications, load tables and installation instructions for each type of decking and accessories. Include manufacturer's certifications to show compliance with supplementary framing, sump pans, cant strips, curb openings, special jointing and other accessories.

1.5 QUALITY ASSURANCE

- A. Structural Testing/Inspection Agency shall perform the following quality related items:
 - 1. Verify placement of deck for alignment and proper lap.
 - 2. Verify deck gage.
 - 3. Verify welds for size and pattern.
 - 4. The inspector shall verify welding procedures and welder qualifications prior to the start of work.
 - 5. The inspector shall perform periodic monitoring of all floor and roof deck welding and shall verify that all welds have been visually inspected prior to the welds being covered.

1.6 STORAGE

- A. Store material off ground to permit easy access for inspection and identification. Store steel members and packaged items in a manner that provides protection against contact with deleterious materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide metal deck sheets of three spans minimum wherever possible.
- B. Metal deck shall be designed to resist the design loads provided in the Contract Documents. The design of the metal deck shall be the sole responsibility of the deck supplier and its design engineer, licensed in the project state.

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2.2 DECK ATTACHMENT

- A. Use E-60 series electrodes conforming to AWS A5.5
- B. Provide weld washers for material thinner than 22 gage.

2.3 COMPOSITE DECK

- A. Composite deck formed from steel sheets having minimum yield strength of 33,000 pounds per square inch shall conform to ASTM A653 or A1008.
- B. Calculated theoretical deflections of the deck, as an unshored form, shall be based on the weight of the concrete (as determined by the design slab thickness) and the weight of the steel deck, uniformly loaded on all spans and shall be limited to $L/180$ or $3/4$ inch, whichever is smaller. Deflections shall be relative to supporting members.
- C. Bearing lengths shall be determined in accordance with the AISI specification. A uniform loading case of wet concrete plus deck weight plus 20 psf construction load shall be used.
- D. Fresh unit weight of normal weight concrete shall be assumed to be 145 pcf. Fresh unit weight of structural-lightweight concrete shall be assumed to be 120 pcf. The total design load for the composite slab shall be 225 psf. Under only the superimposed live load the tensile stress of the deck, between supports, shall not exceed 0.6 times the yield strength of the steel. Under the combination of superimposed live load, the weight of the concrete and the weight of the deck, the tensile stress of the deck, between supports, shall not exceed 0.8 times the yield strength of the steel.
- E. Deflection of the composite slab shall not exceed $L/360$ under the superimposed live load.
- F. Provide phosphatized/painted finish on the exposed side of the deck. The side to be in contact with the concrete may be uncoated, unless galvanized deck is indicated on the Drawings.
- G. Provide galvanized closures for columns, girders, where panels change direction, and end closures for panels not closed by bent plates or other means.

2.4 ROOF DECK

- A. Galvanized metal roof deck formed from steel sheets having a minimum yield strength of 33,000 pounds per square inch shall conform to ASTM A653 or A1008, Grade C. Provide roof deck types and gages as required for the loads indicated on Drawings. Galvanize forms per ASTM A653, G-60.
- B. Provide roof deck with painted finish, unless galvanized finish is indicated on the Drawings. Provide accessories, clips, and other items as required.
- C. Provide roof deck units with flush, nested 2-inch end laps and nested side laps, unless otherwise indicated or specified. Provide deck configurations complying with SDI "Basic Design Specifications".

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- D. Roof deck shall be capable of supporting uniformly distributed loads (dead, live and uplift) as shown on the drawings without exceeding a unit stress of 20,000 psi, and a uniformly distributed live load as shown on the drawings with the live load deflection not to exceed 1/240 of the span length center-to-center of supports.

2.5 ROOF SUMP PANS

- A. When required by Architect fabricate from single piece of 14 gage galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1-1/2 inches below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

2.6 CANT STRIPS

- A. When required by Architect, fabricate cant strips of 20 gage sheet steel. Bend to form a 45 degree cant not less than 5 inches wide with top and bottom flanges not less than 2 inches wide, unless otherwise shown.

PART 3 - EXECUTION

3.1 GENERAL

- A. Load conditions shall be in accordance with Steel Deck Institute sequential loading formulas.
- B. Installer must examine the areas and conditions under which steel decking is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PLACEMENT

- A. Place steel deck units on supporting steel framework and adjust to final position before permanently fastening. Install deck units and accessories in accordance with manufacturer's recommendations and the Drawings, and as specified herein.

3.3 CUTTING

- A. Cut holes in deck indicated by the Drawings. Other holes required shall be supplied by those requiring them. Obtain written authorization for additional holes and cutting not indicated on erection drawings.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on **[both surfaces]** **[top surface]** of prime-painted deck immediately after installation, and apply repair paint.

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3.4 WELDING

- A. Perform welding in accordance with AWS Structural Welding Code.
- B. Provide weld washers for deck thinner than 22 gage.

3.5 CONCENTRATED LOADS

- A. Do not hang concentrated loads exceeding 50 pounds from deck.

3.6 DECK SUPPORTS

- A. Fasten deck to steel framework at ends and at each intermediate support by welding according to manufacturer's specifications unless indicated otherwise on structural drawings or otherwise specified herein. Do not weld deck in place until all bolted and welded connections for the structural frame are complete. A minimum of one floor over the area to be decked is to be bolted and welded prior to welding deck in place.

3.7 COMPOSITE DECK

- A. Place steel floor units in straight alignment. Maintain a maximum space of 1/4 inch between ends of abutting units. In no case shall the ridges of the composite deck be located over beams or girders running parallel to the span of the deck.
- B. Unless shown otherwise on the Drawings, weld panels in place with 3/4- inch puddle welds or shear connectors spaced at not more than twelve inches on center at each support. Fasten side laps with stitch welds 1-1/2 inches long not exceeding a spacing of two feet on center. Where two panels butt, fasten each unit with separate welds. Lapping ends of panels is not acceptable. Side laps may be fastened by screws or button punching if approved by the Structural Engineer.
- C. Fasten closures securely in place with welds or screws at two feet on center to supports and adjacent panels.
- D. Contractor may elect to shore deck to reduce deflection and overrun of concrete. Do not shore structural beams or girders unless indicated on Drawings or authorized in writing by Structural Engineer.
- E. Cut holes in deck after concrete is in place.

3.8 ROOF DECK

- A. Place roof deck in straight alignment. Lap ends of sheets two inches.
- B. Attach side laps of roof deck with screws spaced at a maximum of 24 inches on center for spans greater than 4 feet unless shown otherwise on the Drawings.

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- C. Weld roof deck in place by welding with 5/8-inch puddle welds spaced 12 inches on center at each support unless shown otherwise by the Drawings.

3.9 DAMAGED DECK

- A. The contractor is responsible for protecting the metal deck.
- B. Deck damaged before or during the concreting process will be removed and replaced at the contractor's expense.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General Contractor Provide the following:
 - 1. Non-load-bearing exterior wall framing.
 - 2. Exterior soffit framing.
- B. Related Sections include the following:
 - 1. Division 06 section "Sheathing" for wall sheathing installed in association with exterior non-load bearing wall framing.
 - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 - b. Soffit Framing: Vertical deflection of 1/360 of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch (25 mm).

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5. Design framing system to maintain indicated framing member depths. If require to accommodate design loads, adjust other framing member characteristics, such as gauge, spacing, and bracing.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified structural engineer responsible for their preparation.
- C. Qualification Data: For structural engineer.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Power-actuated anchors.
 3. Mechanical fasteners.
 4. Vertical deflection clips.
 5. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified structural engineer.
- B. Structural Engineer Qualifications: A structural engineer who is legally qualified to practice in the State of Florida and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

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- C. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

- 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. Allied Studco.
 - 2. Clark Steel Framing.
 - 3. Dale/Incor.
 - 4. Dietrich Metal Framing; a Worthington Industries Company.
 - 5. Metal Resources, Inc.
 - 6. United Metal Products, Inc.

2.3 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: ST33H (ST230H) minimum.
 - 2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).

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- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50 (340), Class 1 or 2 minimum.
2. Coating: G90 (Z275).

2.4 NON-LOAD-BEARING WALL FRAMING AND EXTERIOR FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 16 gage minimum, unless noted otherwise. See Drawings for gage requirements.
2. Flange Width: 2 inches (51 mm).

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

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 16 gage minimum, unless noted otherwise.

- D. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.

- E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 16 gage, unless noted otherwise.
2. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

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G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.040 inch (1.02 mm), unless noted otherwise.
2. Depth: 7/8 inch (22.2 mm).

H. Z-Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.030 inch (20 gauge), unless noted otherwise.
2. Depth: As required.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 16 gage minimum, unless noted otherwise.

2.6 FRAMING ACCESSORIES

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

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

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. Foundation clips.
6. Stud kickers, knee braces, and girts.
7. Hole reinforcing plates.
8. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

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

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

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

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

- D. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.

- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

- 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install spray foam insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Install headers over wall openings where called for on the Drawings. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- E. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Connect vertical deflection clips to studs and anchor to building structure.
 - 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- F. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

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- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than **2 inches (51 mm)** from abutting walls, and as follows:
 - 1. Joist Spacing: **16 inches (406 mm)**.
- D. Secure joists to walls to prevent lateral movement of bottom flange.
- E. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
- F. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal ladders.
4. Metal bollards.
5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

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

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel Framing."
4. Section 061600 "Sheathing" for installing expanded metal security mesh.

1.2 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.

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1.3 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. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For ladders and alternating tread devices, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

1.6 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 and alternating tread devices.
- B. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
- C. 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 (67 deg C), ambient; 180 deg F (100 deg C), 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 A 36/A 36M.
- C. Steel Tool Resisting Bars: ASTM A627.
- D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
 - 2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch (1.7-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941

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(ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. 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.
- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

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- 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 D 1187/D 1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- 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 (20 MPa)**.

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 (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

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- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.6 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. Comply with ANSI A14.3 unless otherwise indicated.
- B. Steel Ladders:
 - 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 - 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch- (19-mm-) 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 by coating with abrasive material metallically bonded to rung.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) IKG Industries, a division of Harsco Corporation; Mebac.
 - 2) [Ross Technology Corporation](#).
 - 3) SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
 - 6. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 - 7. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

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2.8 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with zinc-rich primer.

2.9 LOOSE BEARING AND LEVELING PLATES

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

2.10 LOOSE STEEL LINTELS

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

2.11 STEEL WELD PLATES AND ANGLES

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

2.12 FINISHES, GENERAL

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

2.13 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

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- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. 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.

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3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors and power fold doors securely to, and rigidly brace from, building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes **6 inches (150 mm)** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING BEARING AND LEVELING PLATES

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

3.5 ADJUSTING AND CLEANING

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

END OF SECTION 055000

SECTION 055113 - METAL PAN 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. Provide:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Steel tube handrails attached to walls adjacent to metal stairs.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.

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 pan stairs and the following:
 - 1. Prefilled metal-pan-stair treads.
 - 2. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type and finish of nosing.

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- D. Delegated-Design Submittal: For stairs and railing, including analysis data signed and sealed by the qualified professional engineer 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."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
 - 4. Structural steel fabricator of record.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer licensed in the State of Illinois, as defined in Section 014000 "Quality Requirements," 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. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

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2.3 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, **Grade 25** (**Grade 170**), unless another grade is required by design loads; exposed.

2.4 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast aluminum, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Safety Tread Co., Inc.
 - b. Balco, Inc.
 - c. Safe-T-Metal Company, Inc.
 - d. Wooster Products Inc.
 - 2. Configuration: Cross-hatched units, 3 inches (75 mm) wide without lip for casting into concrete of metal pan stairs.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

2.5 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941** (**ASTM F 1941M**), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A** (**ASTM F 568M, Property Class 4.6**); with hex nuts, **ASTM A 563** (**ASTM A 563M**); and, where indicated, flat washers.

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- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- D. 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 B 633 or **ASTM F 1941 (ASTM F 1941M)**, Class Fe/Zn 5, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of **3000 psi (20 MPa)** unless otherwise indicated.
- D. Welded Wire Reinforcement: ASTM A 185/A 185M, **6 by 6 inches (152 by 152 mm)**, W1.4 by W1.4, unless otherwise indicated.

2.7 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 (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.8 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. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
- C. Metal Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than **0.067 inch (1.7 mm)**.
 - 1. Steel Sheet: Uncoated cold-rolled steel sheet.
 - 2. Directly weld metal pans to stringers; locate welds on top of subreads where they are concealed by concrete fill. Do not weld risers to stringers.
 - 3. Shape metal pans to include nosing integral with riser.
 - 4. At Contractor's option, provide stair assemblies with metal pan subreads filled with reinforced concrete during fabrication.
 - 5. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.

2.9 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint as shown in NAAMM AMP 521.
- C. Form changes in direction of railings by bending.
- 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 (6 mm) 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 flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- 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.

2.10 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."

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- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN 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. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
 - 2. Center nosings on tread width.

3.2 INSTALLING RAILINGS

- A. 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 follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

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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 (0.05-mm) dry film thickness.

END OF SECTION 055113

SECTION 055119 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes industrial-type, straight-run stairs with steel-grating treads and railings attached to metal grating stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For metal grating stairs and the following:
 - 1. Paint products.
 - 2. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments.
- C. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 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.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer 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. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

2.2 METALS

- 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.

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- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Grating Crossbars: **ASTM A 510** (**ASTM A 510M**).
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Cast-Abrasive Nosings: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
- G. Tubing: ASTM A 500 (cold formed).
- H. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are indicated or required by structural loads.

2.3 FASTENERS

- A. General: Provide fasteners with coating complying with **ASTM F 1941** (**ASTM F 1941M**), Class Fe/Zn 12, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A** (**ASTM F 568M, Property Class 4.6**); with hex nuts, **ASTM A 563** (**ASTM A 563M**); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, **ASTM A 563** (**ASTM A 563M**); and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.
- 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. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.

2.4 MISCELLANEOUS MATERIALS

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

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- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- 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. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, 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. Form exposed work with accurate angles and surfaces and straight edges.
- C. 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 4 welds: good quality, uniform undressed weld with minimal splatter.
- D. Fabricate joints that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Industrial 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.

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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. Finish: Shop primed.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
1. Fabricate treads and platforms from welded steel grating with 1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 11/16 inch (17 mm) o.c. and crossbars at 4 inches (100 mm) o.c.
 2. Surface: Plain.
 3. Finish: Galvanized.
 4. Fabricate grating treads with cast-abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
 5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings" and as specified herein.
1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
 2. Connect posts to stair framing by direct welding unless otherwise indicated.
- B. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Rails and Posts: 1-1/2-inch- (38-mm-) top and bottom rails and 1-1/2-inch- (38-mm-) posts.
 2. Intermediate Rails Infill: 1-1/2-inch- (38-mm-) square intermediate rails.
 3. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with cam-type, self-closing hinges for fastening to post and latch.
 4. Finish: Shop primed.
- C. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.
- D. Form changes in direction of railings as follows:
1. By bending.

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- E. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. Connect posts to stair framing by direct welding unless otherwise indicated.
 - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

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

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

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

3.3 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required complying with performance requirements.

3.4 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055119

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe railings.

B. Related Requirements:

1. Section 055113 "Metal Pan Stairs" for steel tube railing associated with metal pan stairs.
2. Section 055119 "Metal Grating Stairs" for steel tube railings associated with metal grating stairs.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout, anchoring cement, and paint products.

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

C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- C. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.5 QUALITY ASSURANCE

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

1.6 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 to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

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2.2 METALS, GENERAL

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

2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40) and Extra Strong (Schedule 80), unless another grade and weight are indicated or required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 FASTENERS

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

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2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, **ASTM F 593** (**ASTM F 738M**), and nuts, **ASTM F 594** (**ASTM F 836M**).

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 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. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch** (**1 mm**) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- F. Connections: Fabricate railings with welded connections unless otherwise indicated.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.

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3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form Changes in Direction as follows:

1. By bending.

I. 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.

J. Close exposed ends of railing members with prefabricated end fittings.

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

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

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 - 2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

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

3.3 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel pipe railings, weld flanges to post and to metal supporting surfaces.

3.4 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

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B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in security expansion shields and hanger or lag bolts.

3.5 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055213

SECTION 055913 – SECURITY SOFFITS

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. A factory-fabricated steel cover support system with concealed mounted attachment clamps, for concealment of Fire Sprinkler Systems, Piping, HVAC, Conduit, Wiring or Cable
- B. Related Requirements:
 - 1. Division 04 Section “Unit Masonry Assemblies”
 - 2. Division 05 Section “Metal Fabrications”
 - 3. Division 05 Section “Tamper Proof Metal Fasteners”
 - 4. Division 07 Section “Security Joint Sealants”
 - 5. Division 21 for Fire Suppression
 - 6. Division 22 for Plumbing
 - 7. Division 23 for Heating Ventilating and Air Conditioning
 - 8. Division 26 for Electrical
 - 9. Division 27 for Communications
 - 10. Division 28 for Electronic Safety and Security

1.3 DESCRIPTION

- A. The soffit/cover system shall incorporate a concealed snap-lock connection, which, once assembled, renders the cover essentially irremovable with the use of ordinary tools.

1.4 SUBMITTALS

- A. Submit copies of manufacturer's specifications, installation instructions, and product data.

1.5 JOB CONDITIONS

- A. Coordinate installation soffit/cover system with all other trades.

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PART 2 - PRODUCTS

2.1 FACTORY-FABRICATED STEEL COVER SUPPORT SYSTEM

A. Approved Sources:

1. JG Innovations, Inc., 121 E Burbank Ave., P.O. Box 8128, Janesville, WI 53547-8128, Phone #: 888-933-2248
2. In-Ex Systems, Inc., 4473 Cavallon Way, Acworth, GA 30101, Phone #: 800-483-8201

B. Material

1. Support/Attachment Devices

- a. Spring steel shield clips of the size recommended by manufacturer, for securement of the cover. Clips shall be produced from 21 Gauge minimum zinc-plated spring steel and shall have a reverse curvature design such that the clips soundly secure the soffit from easy removal. Each clip must be demonstrated as being able to resist a force of 200 lbs. uplift at the free end. Test results shall be available upon request.

2. Soffit/Cover

- a. The soffit/cover shall be smooth in appearance and shall be made of 16 Gauge A60/G90 galvanized steel, with a paint grip finish and factory painted of a color to be specified by the owner's representative. The cover shall have a snap-lock interfacing with the clips such that once assembled, it is rendered virtually irremovable with the use of ordinary tools.
- b. The soffit and related fittings shall be factory painted with Sherwin Williams epoxy polyester hybrid powder coating of a color to be specified by the owner's representative. Matching touch-up paint shall be supplied to the owner by the manufacturer.
- c. Cover manufacturer shall be staffed with a licensed engineer having a minimum of five year's experience with such systems.
- d. The soffit/cover shall be sized in accordance with requirements to accommodate the specific application size as specified by the project documents, specifications and blue prints, provided to the cover manufacturer prior to bid date.
- e. L-Shield soffit profile for sidewall installations and/or U-Shield soffit profile for sidewall and/or pendant installations respectively.
- f. Cover joints shall be interlocking integral joints with provision for securement utilizing stainless steel rivets. Rivet spacing shall be at no greater than 2" intervals along the joint and positioned at a distance no greater than 1" from the end of the overlapping section. External couplings will NOT be allowed.
- g. Cover design shall include a roll-formed "groove" at the interfacing of the cover and the adjacent construction surface to facilitate the application of sealant/adhesive compounds and enhance the security of such compounds from dislodging.

3. Accessories

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- a. The system shall include tamper-resistant end caps, prefabricated corners, wall flanges, couplings, and other items, which may be necessary to complete the system, and shall be installed in accordance with manufacturer recommendations.
- b. Spare Parts - The installing contractor shall supply the owner with quantities of spare parts equal to a minimum of five percent (5%) of the total quantities of each soffit part utilized in this installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of system shall be in strict accordance with approved shop drawings and manufacturer's printed instructions.
 1. If used to conceal fire sprinkler systems, the sprinkler contractor/engineer must determine the piping and sprinkler layout, including sprinkler head locations and pipe support locations (based on pipe manufacturer's specifications). Indicate areas on drawings where cover system is to be used.
 2. Select appropriate fasteners for the substrate encountered to adequately secure the pipe and cover system.
 3. To insure that the cover is linear and snug-fitting when installed, it is imperative that its support devices are anchored squarely and firmly against the structural surface in a straight line.
 4. All penetrations to the soffit/cover system must be field cut to prevent misalignment with intended protrusion. The exceptions to this are that access doors will be factory furnished and installed and perforations, if required, for ventilation purposes will be factory perforated.
 5. Guidelines for installation of modular soffit/cover system shall be supplied by the manufacturer of said system and the installing contractor shall adhere to the manufacturer's guidelines.
 6. All field cut ends and scratches shall be "touched up" (spray or brush) with a matching paint.
 7. Manufacturer shall supply on-site installation instruction, upon installer's request, by a qualified installation instructor for a minimum of one day for the project start-up (1,500 lineal feet minimum.)
 8. The completed installation shall be visibly searched for voids between the interfacing of the cover and construction surface. Voids shall be sealed with a color matching siliconized caulk or urethane caulk.

END OF SECTION 055913

SECTION 057513 –SECURITY WIRE MESH

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. Security Wire Mesh:
 - a. As a penetration barrier.
 - b. As a penetration barrier behind wall board using the manufacturers' recommended method of installation.
- B. Related Requirements:
 - 1. Division 05 Section "Metal Fabrications"
 - 2. Division 09 Section "Non-Structural Metal Framing"
 - 3. Division 09 Section "Gypsum Board"

1.3 REFERENCES

- A. All components and parts in this specification shall meet or exceed current standards and specifications as designated by the American Society for Testing and Materials and shall be certified Security Mesh per ASTM F1267, Type 2, Class 1 mill finish.
- B. Underwriters Laboratories Fire Rated Assemblies (per U/L subject File #1857) will not be jeopardized by using Security Mesh in the fire rated assembly.

1.4 SYSTEM DESCRIPTION

- A. Security Wire Mesh shall be made from a sheet of steel that is simultaneously slit and stretched into a rigid and open continuous sheet that cannot unravel. The finished shape of the mesh openings shall be a flattened diamond.

1.5 SUBMITTAL

- A. Product Data:

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1. Include material descriptions, dimensions and profiles, and finishes.

B. Samples:

1. 12 by 12 inches (305 by 305 mm) section of the security wire mesh.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle per manufacturer's requirements.
- B. Protect units and finishes from damage during shipping, storage, handling, installation and construction of other work in the same area.

PART 2 - MATERIALS

2.1 SECURITY WIRE MESH

A. Acceptable Manufacturers

1. Alabama Metal Industries Corporation (AMICO), 3245 Fayette Avenue u Birmingham, Alabama 35208; 800-366-2642.
2. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360.
3. Niles International, 310 North Pleasant Ave., Niles, Ohio 44446; 800-321-2727.

B. Material

1. The Security Mesh used shall conform to the following specification:
 - a. Carbon steel – meet or exceed ASTM A-1011
 - b. Sheet size: 48 by 96 inches (1219 by 2438 mm).
 - c. Mesh diamond width – 0.923 inch x 2.120 inch long bond to bond with 13 diamonds per foot
 - d. Mesh size opening – width 0.563 inch x 1.688 inch long allowing 63% open area
 - e. Mesh strand width – 0.164 inch
 - f. Mesh strand thickness – 0.120 inch
 - g. Weight – 1.71 pounds per square foot
 - h. Tolerances:
 - 1) SWD = -0 + 1/4" per foot of dimension
 - 2) LWD = -0 + 1/4" per foot of dimension
2. Security Mesh shall be attached to framing members using manufacturer's security clips and the appropriate threaded fasteners when used as a penetration barrier behind wall board.
 - a. Flat bugle head self-tapping screws long enough to penetrate steel framing by at

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least 3/8-inch.

3. Install Security Clips, at a minimum, on 12-inch centers per framing member.

C. Finish

1. Security Mesh is supplied “mill finish” HR P&O.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Preparation: Prior to sheet fabrication, field verify required dimensions.
- B. Install in accordance with manufacturer's installation instructions and approved shop drawings.

END OF SECTION 057513

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Wood furring.
3. Plywood blocking and nailers.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than **2 inches nominal (38 mm actual)** size in least dimension.
- B. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater size but less than **5 inches nominal (114 mm actual)** size in least dimension.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

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

1. Preservative-treated wood.
2. Power-driven fasteners.
3. Post-installed anchors.

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4. Metal framing anchors.

1.5 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. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 1. Factory mark panels to indicate compliance with applicable standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A 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.
- 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 items indicated on Drawings, and the following:
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

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 E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) 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 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 to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- A. 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.
- B. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- C. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: Construction or No. 2 grade lumber of any species.

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- 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 wall panel systems, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

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

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide hot dipped zinc coated fasteners, ASTM A 153.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with **ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).**

2.7 MISCELLANEOUS MATERIALS

- A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

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 accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to substrate; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches (406 mm)** o.c.
- E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches (2438 mm)** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- F. 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.
- G. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach 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.
 - 2. ICC-ES evaluation report for fastener.
- J. Make tight connections between members. Install fasteners without splitting wood.

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- K. Comply with manufacturer's written instructions for applying field treatment of fire retardant to cut surfaces and non-treated lumber.

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.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Wall Panel Systems: Install ~~1-by-3-inch nominal-~~
(19-by-63-mm actual-) size furring.

3.4 PROTECTION

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

END OF SECTION 061053

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior standing and running trim.

1.3 COORDINATION

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

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Standing and running trim.
 - 2. Anchors.
 - 3. Adhesives.
- B. Shop Drawings:
 - 1. Include the following:
 - a. Dimensioned plans, elevations, and sections.
 - b. Attachment details.
 - 2. Show large-scale details.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
- C. Samples: For each exposed product and for each shop-applied color and finish specified.
 - 1. Standing and Running Trim: 12 inches (300 mm) long

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Deliver all materials in original packaging, unopened with no visible damage.
- C. Store and protect all materials in accordance with manufacturer's requirements for environmental and physical protection. Keep temporary protective coverings in place.
- D. Store products on flat level surface to prevent warping.
- E. Protect materials and finish from damage during handling and installation.
- F. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Allow at least 24 hours for materials to adapt to conditions at project site prior to installation.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Manufactured Polyurethane Trim and Moldings:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Fypon, LLC; MLD1037 Crown Molding or a comparable product by one of the following:
 - a. AZEK Building Products, Inc.
 - b. Flex Trim.
- B. Accessories:
 - 1. Sealant: Use a compatible urethane-based adhesive.
 - 2. Fasteners: Use corrosive-resistant fasteners.

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3. Filler: Use a compatible filler putty.

- C. Finish: Manufacturer supplied protective barrier coat primer, resistant to UV degradation, providing interim UV protection of products which is suitable for field application of 100% acrylic latex finish paint on all urethane foam products.

2.2 FABRICATION

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 24 hours prior to beginning of installation.
- B. Protect surrounding and adjacent work as required preventing damage to preceding work during execution of this work.
- C. Perform all preparation necessary for a successful installation of products as specified in manufacturer's installation instructions.

3.2 INSTALLATION

- A. Obtain Manufacturer's instructions for successful installation of work to be performed and become knowledgeable with all material handling and installation recommendations.
- B. Ensure full compliance with Manufacturer's instructions in all aspects of tasks required by this work. Install products in accordance with manufacturer's instructions at locations indicated on the drawings.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
1. Use fine finishing nails or finishing screws for fastening, countersunk and filled flush with interior architectural woodwork.
- F. Standing and Running Trim:
1. Install with minimum number of joints possible, using full-length pieces (from maximum length available) to greatest extent possible.

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2. Scarf running joints and stagger in adjacent and related members.
3. Fill gaps, if any, between top of base and wall with compatible sealant, painted to match wall.
4. Install standing and running trim with no more variation from a straight line than **1/8 inch in 96 inches (3 mm in 2400 mm)**.

3.3 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects.
- B. Where not possible to repair as acceptable to Architect, replace defective woodwork.
- C. Field Finish: See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.4 CLEANING

- A. Clean all surfaces following manufacturer's recommendations prior to final project completion. Do not use harsh cleaning materials or methods that would damage finish.

END OF SECTION 064023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing 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.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including high-pressure decorative laminate, panel products, fire-retardant-treated materials, and cabinet hardware and accessories.

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

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

C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.

D. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.
4. Cabinet hardware finish.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For the following:

1. Composite wood products.
2. Thermoset decorative panels.
3. High-pressure decorative laminate.
4. Adhesives.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. 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. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate:
 - 1. NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 2. Products: As indicated on Interior Finish Legend on Drawings
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade VGS.
 - 3. Edges: Grade HGS or hardwood edging where indicated.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish, unless otherwise indicated on Drawings.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

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- J. 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.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood 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, medium-density overlay.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 120 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100: Side mounted; full extension with over travel type; progressive movement; zinc-plated-steel ball-bearing slides.
 - 2. For drawers not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 - 3. For computer keyboard shelves, provide Grade 1HD-100.

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- F. Door and Drawer Locks: BHMA A156.11.
 - 1. Provide a minimum of two keys per lock and two master keys.
 - 2. Provide on all drawers and doors.
 - 3. Keying: Key locks as directed by Owner. Keying to be approved by Owner prior to lock installation.
 - 4. Master Key System: Key all locks to be operable by master key.
- 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 Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base; BHMA 682 for zinc base.
- 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: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated, including venting where indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for

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shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing.

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- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips or 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 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.
3. Sound attenuation blanket.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
- B. Manufacturers:
 1. CertainTeed Corporation.
 2. Johns Manville.
 3. Knauf Fiber Glass.
 4. Owens Corning.

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2.2 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type IA (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
- B. Manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Knauf Fiber Glass.
 - 4. Owens Corning.

2.3 SOUND ATTENUATION BLANKET

- A. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- B. Manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Knauf Fiber Glass.
 - 4. Owens Corning.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

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- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

3.4 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 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Cover board.

- B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 077129 "Manufactured Roof Expansion Joints" for expansion joint to be installed in roofing system.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.4 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

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5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav or SPRI's Directory of Roof Assemblies listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes.
- C. Samples for Verification: For the following products:
 1. Roof membrane and flashings, of color required.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

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- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

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

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1.11 WARRANTY

- A. System Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. System warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, accessories, roof edge metal and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
 - a. Limit of Liability: No dollar limitation.
 - b. Scope of Coverage: Repair leaks in the roofing system caused by:
 - 1) Ordinary wear and tear of the elements.
 - 2) Manufacturing defect in materials.
 - 3) Defective workmanship used to install these materials.
 - 4) Damage due to winds up to 72 mph.
 - 5) Failure of metal roof edge material, including copings and gravel stops.
 - 6) Hail coverage for hail up to 1" in diameter.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, fasteners, cover boards, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

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1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Wind Uplift Load Capacity: 90 psf.
- E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Versico Roofing Systems ; VersiWeld TPO Membrane. or a comparable product by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Tremco Incorporated.
 2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
 3. Thickness: 60 mils (1.5 mm), nominal.
 4. Exposed Face Color: White.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesive, Primers and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

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- D. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch (100-mm) diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Slip Sheet: ASTM D2178/D2178M, Type IV; glass fiber; asphalt-impregnated felt.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 2, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Firestone Building Products.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Rmax, Inc.
 - 2. Compressive Strength: 20 psi (138 kPa).
 - 3. Size: 48 by 96 inches (1219 by 2438 mm).
 - 4. Thickness:
 - a. Base Layer: 1-1/2 inches (38 mm).
 - b. Upper Layers: As needed to obtain required R-value.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch (6.35 mm).
 - 3. Slope:

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- a. Roof Field: 1/8 inch per foot (1:96) unless otherwise indicated on Drawings.
- b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- C. Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2-inch- (13-mm-) thick polyisocyanurate, with a minimum compressive strength of 80 psi (551 kPa). Glass-fiber mat facer on both major surfaces.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Versico Roofing Systems ; SecurShield HD or a comparable product by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Johns Manville; a Berkshire Hathaway company
 2. Thickness: 1/2 inch (13 mm).
 3. R-Value: Minimum 2.5 per 1/2" thickness.

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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify any damaged sections of gypsum panel decks have been repaired or replaced.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime gypsum substrate as required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

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- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Gypsum Decks:
 - 1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows and end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - f. Adhere base layer of insulation to vapor retarder according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place OR:
 - 2) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches (305 mm) in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - g. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

- h. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place OR:
 - 2) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Offset both long joints and end joints at each layer of cover board.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place OR:
 - b. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

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

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- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
 - 1. Provide EPDM boot flashing at overflow roof drain piping; or provide other acceptable means of flashing these pipes due to limited clearances.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 INSTALLATION OF WALKWAYS

- A. Flexible Walkways:
 - 1. Install flexible walkways at the following locations:
 - a. Top and bottom of each roof access ladder.
 - b. Locations indicated on Drawings.
 - c. As required by roof membrane manufacturer's warranty requirements.

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2. Provide **6-inch (76-mm)** clearance between adjoining pads, except at overflow roof drains; walkways to be butted together.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's representative shall visit the site at least twice and perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

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

3.12 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner: **<Insert name of Owner>**.
 2. Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Acceptance Date: _____.
 7. Warranty Period: **<Insert time>**.

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8. Expiration Date: _____.

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph (m/sec)>;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

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6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

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 low-slope roof sheet metal fabrications.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 075423 "Thermoplastic polyolefin (TPO) roofing" for membrane roofing products and warranty requirements.

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 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

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

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1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Sample Warranty: For special warranty.
- C. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested and FM Approvals approved.

1.7 CLOSEOUT SUBMITTALS

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

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1.8 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. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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.

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- C. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- D. 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 (67 deg C), ambient; 180 deg F (100 deg C), 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. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: Match existing color – to be selected by Architect from manufacturers standard colors.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.4 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 or manufactured item unless otherwise indicated.

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- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- 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 (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 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 (6 mm in 6 m) on slope and location lines indicated on

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Drawings and within 1/8-inch (3-mm) 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 (25 mm) 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 and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long sections. Furnish with 6-inch- (150-mm-) wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate.
 - 2. Fabricate from the Following Materials:
 - a. Galvanized Steel: minimum 22 gauge thick.
 - 3. Profile: As indicated on drawings.
- B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
 - 1. Coping Profile: Match existing, Fig. 3-4A.
 - 2. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate
 - 3. Fabricate from the Following Materials:
 - a. Galvanized Steel: minimum 22 gauge thick.
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

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1. Galvanized Steel: 22 gauge thick.
- D. Counterflashing: Fabricate from the following materials:
1. Galvanized Steel: 22 gauge 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.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- 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. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
 6. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 7. Torch cutting of sheet metal flashing and trim is not permitted.
 8. Do not use graphite pencils to mark metal surfaces.
 9. No visible fasteners on exterior side of the coping or scuppers.
- 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

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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 and stainless-steel 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 (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- 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 (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), 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 (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, 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. Roof Edge Flashing:
1. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Copings:

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1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- D. 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 (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

3.4 ERECTION TOLERANCES

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

3.5 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.

END OF SECTION 076200

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

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. Bellows-type roof expansion joints.
- B. Related Requirements:
 - 1. Division 06 Section "Miscellaneous Carpentry" for wooden curbs or cants for mounting roof expansion joints.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roof expansion joints.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
 - 3. Provide isometric drawings of intersections, terminations, and changes in joint direction or planes, depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

1.5 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Roof expansion joints shall withstand exposure to weather, remain watertight, and resist the movements indicated without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint-cover assembly, consisting of exposed membrane bellows, laminated to flexible, closed-cell support foam, and secured along each edge to a 3- to 4-inch- (76- to 100-mm-) wide metal flange for nailing to substrate. Provide each size and type indicated, factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints, splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation. Fabricate each assembly specifically for installation configuration indicated on Drawings.
 - 1. Products:
 - a. Architectural Art Mfg., Inc.; T Series Roof Expansion Cover.
 - b. Balco Metalines, a division of Balco, Inc.; Type BRBG Roof Bellows.
 - c. C/S Group; Model BRJ.
 - 2. Joint Movement Capability: Plus and minus 50 percent of joint size.
 - 3. Bellows: Manufacturer's standard flexible membrane.
 - a. Color: Black.
 - 4. Flanges: Galvanized steel, 0.022 inch (0.56 mm) thick.
 - a. Form: As indicated on Drawings.
 - 5. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to exterior-wall expansion joint cover.

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- b. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed glass-fiber insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84.

2.3 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, hot-dip zinc-coating designation G90 (Z275).
- B. EPDM Membrane: ASTM D 4637, Type standard with manufacturer for application.
- C. Neoprene Membrane: Neoprene sheet recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil; and as standard with roof-expansion-joint manufacturer for application.
- D. PVC Membrane: ASTM D 4434, Type standard with manufacturer for application.
- E. Silicone Extrusions: ASTM D 2000, UV stabilized, and that does not propagate flame.
- F. Adhesives: As recommended by roof-expansion-joint manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Adhesives: As recommended by roof-expansion-joint manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- H. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- I. Mineral-Fiber Blanket: ASTM C 665.
- J. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine roof-joint openings, inside surfaces of parapets, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 - 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 - 2. Install roof expansion joints true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 3. Provide for linear thermal expansion of roof expansion joint materials.
 - 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 - 5. Provide uniform, neat seams.
 - 6. Install roof expansion joints to fit substrates and to result in watertight performance.
 - 7. Torch cutting of roof expansion joints is not permitted.
 - 8. Do not use graphite pencils to mark aluminum surfaces.
- B. Directional Changes and Other Expansion-Control Joint Systems: Coordinate installation of roof expansion joints with other expansion-control joint systems to result in watertight performance.
- C. Splices: Splice roof expansion joints with materials provided by roof-expansion-joint manufacturer for this purpose, to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- D. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

3.3 PROTECTION

- A. Protect roof expansion joints from foot traffic, displacement, or other damage.
- B. Remove and replace roof expansion joints and components that become damaged by moisture or otherwise.

END OF SECTION 077129

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in smoke barriers.

B. Related Requirements:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

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

1.3 INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

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1.5 PROJECT CONDITIONS

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

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. Fire-Stop Systems.

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- c. Hevi-Duty/Nelson.
 - d. Hilti, Inc.
 - e. Specified Technologies, Inc.
 - f. Tremco, Inc.
 - g. United States Gypsum Company.
 - h. Or equal.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of **0.01-inch wg (2.49 Pa)**.
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of **0.30-inch wg (74.7 Pa)**.
1. L-Rating: Not exceeding **5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m)** of penetration opening at and no more than **50-cfm (0.024-cu. m/s)** cumulative total for any **100 sq. ft. (9.3 sq. m)** at both ambient and elevated temperatures.
- D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- E. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
1. Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- F. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

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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 sleeve lined with an intumescent strip, a 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 intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- 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.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- 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.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.

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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. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency, including tested system number.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.
 7. Product.
 8. Hour rating.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

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3.6 CLEANING AND PROTECTION

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

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.2 ACTION SUBMITTALS

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

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems 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

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requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

1.5 PROJECT CONDITIONS

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

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint

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systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
- C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
- D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- F. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

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

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be

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visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

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

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant.
- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
1. Joint-sealant location and designation.
 2. Manufacturer and product name.
 3. Type of substrate material.
 4. Proposed test.
 5. Number of samples required.
- D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

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2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

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

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

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

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1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

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2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT, A, G, M, O.

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

- a. Dow Corning Corporation; 791.
- b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2000 Silpruf.
- c. Pecora Corporation; PCS.
- d. Or equal.

- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses NT, A, G.

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

- a. Dow Corning Corporation; 799.
- b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1000.
- c. Pecora Corporation; 896.
- d. Or equal.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.

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

- a. BASF Corporation-Construction Systems; MasterSeal NP 2 (Pre-2014: Sonolastic NP2).
- b. Pecora Corporation; Dynatred.
- c. Sika Corporation; Sikaflex - 2c NS EZ Mix.
- d. Or equal.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

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- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

- a. Dow Corning Corporation; 786-M White.
- b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
- c. Pecora Corporation; Pecora 860.
- d. Tremco Incorporated; Tremsil 200.
- e. Or equal.

2.5 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

- a. BASF Corporation-Construction Systems; Sonolac.
- b. Pecora Corporation; AC-20.
- c. Tremco Incorporated; Tremflex 834.
- d. Or equal.

2.6 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 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

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harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

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

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

- a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

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

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair 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 on Drawings.

2. Joint Sealant: Urethane, M, NS, 25, T, NT (See 2.3.A above).

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast concrete units.
 - c. Joints in exterior insulation and finish systems.
 - d. Joints between metal panels.
 - e. Joints between different materials listed above.
 - f. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - g. Control and expansion joints in ceilings and other overhead surfaces.
 - h. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, NS, 50, NT (See 2.2.A above).

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- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Metal and Glass.
 - b. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, S, NS, 50, T, NT (See 2.2.B above).
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, NS, 25, T, NT (See 2.3.A above).
- E. 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. Joints between plant-precast architectural concrete units where not indicated to be a security sealant.
 - c. Control and expansion joints in unit masonry.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, NS, 25, NT (See 2.3.A above).
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex (See 2.5.A above).
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

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- b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
- 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT (See 2.4.B above).

END OF SECTION 079200

SECTION 079223 – SECURITY 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. Security joint sealant.
 - 2. Security gap filler (Low-Mod Gel Sealant).
- B. Related Requirements:
 - 1. Division 03 for Concrete
 - 2. Division 04 for Masonry
 - 3. Division 05 for Metals
 - 4. Division 08 for Openings
 - 5. Division 11 for Detention Equipment
 - 6. Division 13 for Special Construction
 - 7. Division 21 for Fire Suppression
 - 8. Division 22 for Plumbing
 - 9. Division 23 for Heating Ventilating and Air Conditioning
 - 10. Division 26 for Electrical
 - 11. Division 27 for Communications
 - 12. Division 28 for Electronic Safety & Security

1.3 SUBMITTALS

- A. Product Data: For each joint sealant product indicated.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- B. Certificates by Manufacturer: That products supplied complies with performance requirements specified and are suitable for the use indicated.
- C. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

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- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 SECURITY JOINT SEALANT

- A. Product/Manufacturer:
 - 1. SikaFlex –2c NS TG/Sika Corp.
 - 2. Dyna Flex/Pecora Corp.
 - 3. MasterSeal CR 195/BASF

2.3 SECURITY EPOXY RESIN GAP FILLER (LOW-MOD GEL SEALANT)

- A. Product/Manufacturer:
 - 1. Sika-Dur 23/Sika Corp.
 - 2. DynaPoxy/Pecora Corp.
 - 3. MasterEmaco ADH 327/BASF

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.5 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.

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- 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 in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 LOCATIONS

- A. Provide security joint sealants and security gap filler work as required under the General, Mechanical, and Electrical Sections. See drawings and security matrix at the end of this Section.

3.2 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. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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 concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

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- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.4 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

3.5 CLEANING

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

3.6 PROTECTION

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

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3.7 SEALANT MATRIX

LOCATIONS	INTAKE, CELL PODS, DAYROOMS MEDICAL, EXERCISE AND CIRCULATION	DORMITORY AND PROGRAM AREAS	ADMIN. AND STAFF AREAS
DETENTION HOLLOW METAL FRAMES	SGF	SGF	SGF
ARCH. DOOR & WINDOW FRAMES	SJS	LJS	LJS
FLOOR JOINTS	SGF	SGF	Not required
CEILING JOINTS	SGF	SGF	Not required
MECH. GRILLES/ DIFFUSERS	SGF	SJS	LJS
SECURITY SINKS, SHOWERS	SGF	SJS	LJS
WATER CLOSETS & LAVATORIES	SGF	SJS	LJS
SPRINKLER HEADS/ PLUMBING	SGF	SJS	LJS
SECURITY LIGHT FIXTURES	SGF	SJS	LJS
EXPOSED CONDUIT /RACEWAYS	SGF	SJS	SJS
SWITCH/OUTLET	SJS	SJS	LJS
INMATE DURESS PLATES	SJS	SJS	LJS
MICS. DETENTION EQUIP. (MIRRORS)	SGF	SGF	SGF
INTERIOR MASONRY UNITS AT BASE	SGF	SGF	SGF
WALL AND CEILING JOINT	SJS	SJS	LJS
INTERCOM CALLSTATIONS	SJS	SJS	LJS

- A. LJS/Latex Joint Sealants (See Specification Section 079200 for Joints Sealants).
- B. SJS/Security Joint Sealant.
- C. SGF/Security Gap Filler (Low-Mod Gel Sealant).

END OF SECTION 079223

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes steel doors, door frames, and window frames as shown on the Drawings, scheduled and specified, to include:
 - 1. Standard steel doors and frames.
 - 2. Fire rated doors and frames.
 - 3. Borrowed lites and windows.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

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

1.3 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance 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. Details of each different wall opening condition.
 - 5. Details of anchorages, joints, field splices, and connections.
 - 6. Details of moldings, removable stops, and glazing.
 - 7. Details of conduit and preparations for power, signal, and control systems.

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C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 127 mm)**.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 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.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- D. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum **4-inch- (102-mm-)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.
 3. Hollow Metal Inc.
 4. Republic Doors and Frames.
 5. Steelcraft; an Allegion brand.
- 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 indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone and protection level indicated on the Drawings.
 - 1. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
- C. Hurricane Resistance: Provide hollow metal doors and frames that meet the Hurricane Resistant Exterior Openings for the State of Florida including the High Velocity Hurricane Zones (HVHZ) requirements.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames:
 - 1. Fabrication Standard:
 - a. Standard Hollow Metal Work: SDI A250.8, Level 3.
 - 2. Physical Performance: Level A according to SDI A250.4.
 - 3. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 4. Frames:
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.067 inch (1.7 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.

- c. Construction: Full profile welded.
- 5. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames:
 - 1. Fabrication Standard:
 - a. Standard Hollow Metal Work: SDI A250.8, Level 3.
 - 2. Physical Performance: Level A according to SDI A250.4.
 - 3. Doors: For doors up to 36 inches wide.
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, core at manufacturer's discretion.
 - 4. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
 - 5. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
 - 1. Interior Frames: Uncoated steel sheet.
 - 2. Exterior Frames: Metallic-coated steel sheet.
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

- D. Provide countersunk, security screws and bolts for exposed fasteners unless otherwise indicated.

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 (1.0 mm)** thick, with corrugated or perforated straps not less than **2 inches (51 mm)** wide by **10 inches (254 mm)** long; or wire anchors not less than **0.177 inch (4.5 mm)** thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than **0.042 inch (1.0 mm)** thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum **3/8-inch (9.5-mm)** diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

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

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at finish floor surface.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Grout: ASTM C 476, except with a maximum slump of **4 inches (102 mm)**, as measured according to ASTM C 143/C 143M.
- F. Glazing: Comply with requirements in Section 088000 "Glazing."

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

2.8 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. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
- 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
- 3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
- 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
- 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
- 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

- 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. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
- 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 (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

- 1) Two anchors per jamb up to 60 inches (1524 mm) high.

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- 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) high at hinge and strike levels.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) 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.
 3. Hinge plate and strike plate backers to be welded to frame.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 3. Provide loose stops and moldings on inside of hollow-metal work.
 4. 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-~~ (0.5-mm-) thick, cold-rolled steel sheet set into ~~0.032-inch-~~ (0.8-mm-) thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. 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~~ (0.4 mm) thick.

2.11 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of ~~0.020-inch-~~ (0.5-mm-) thick, cold-rolled steel sheet set into ~~0.032-inch-~~ (0.8-mm-) 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. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

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 for doors and other openings, of size and profile indicated. Comply with SDI 105 "Recommended Erection Instructions For Steel Frames".
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

- g. Field apply bituminous coating to backs of frames that will be filled with grout.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Coordinate installation of frames to allow for solidly filling space between frames and concrete with grout.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. In-Place Metal or Wood-Stud Partitions: Secure frames in place according to manufacturer's written instructions.
 - 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
 - C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified in SDI-100.
 - 1. Fire-Rated Doors: Fit fire-rated doors with clearances as specified in their listing.
 - D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow-metal work immediately after installation.

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- 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 087100 – ARCHITECTURAL 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. 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. Automatic operators.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 06 Section “Rough Carpentry”.
 - 2. Division 06 Section “Finish Carpentry”.
 - 3. Division 08 Section “Hollow Metal Doors and Frames”.
- 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. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
 - 3. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
 - 4. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
 - 5. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
 - 6. ICC/IBC - International Building Code.
 - 7. NFPA 70 - National Electrical Code.
 - 8. NFPA 80 - Fire Doors and Windows.
 - 9. NFPA 101 - Life Safety Code.

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10. NFPA 105 - Installation of Smoke Door Assemblies.
11. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
12. TAS-201-94 - Impact Test Procedures.
13. TAS-202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.
14. TAS-203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
15. State Building Codes, Local Amendments.

E. 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. 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. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.
- E. 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.
- F. Informational Submittals:
1. Hurricane Resistant Openings (State of Florida): Within the State of Florida, provide copy of current State of Florida Product Approval or Metro-Dade County Notice of Acceptance (NOA) as proof of compliance that doors, frames and hardware for exterior opening assemblies have been tested and approved for use at the wind load and design pressure level requirements specified for the Project.
 - a. Hurricane Resistant Components (State of Florida): Within the State of Florida, provide copy of independent, third party certified listing to ANSI A250.13.
 2. 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.
- G. 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 Submittals.

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. 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.
- C. 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.
- D. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.
- 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. Hurricane Resistant Exterior Openings (State of Florida including the High Velocity Hurricane Zone (HVHZ)): Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the wind loads, design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.
 - 1. Each unit to bear third party permanent label in accordance with the Florida Building Code requirements.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

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- H. 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.
- I. 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
- J. 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

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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. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.
 - 3. Five years for motorized electric latch retraction exit devices.
 - 4. Two years for electromechanical door hardware.

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 certified 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.

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4. Hinge Options: Comply with the following:

- a. Non-removable Pins: 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) - CB Series.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
- c. Stanley Hardware (ST) - CB Series.

- B. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

- a. Architectural Builders Hardware (AH).
- b. Ives (IV).
- c. Rixson Door Controls (RF).

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 Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
- b. Securitron (SU) - EL-CEPT Series.
- c. Von Duprin (VD) - EPT-10 Series.

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- 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 Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. Hager Companies (HA) - Quick Connect.
- b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
- c. Stanley Hardware (ST) – WH Series.

2.4 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls 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. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
- 5. Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (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.

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- B. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. 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.
- C. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
 - a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
 2. Manufacturers:
 - a. Sargent Manufacturing (SA) - Degree Series.
 - b. Corbin Russwin (RU) – Access 3 Series.
 - c. Medeco Mfg (ME) - Medeco 3
- D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "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. New System: Key locks to a new key system as directed by the Owner.
- 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.

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- H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, High Security: ANSI/BHMA A156.13, Series 1000, Operational and Security Grade 1 certified mortise locksets conforming to impact requirements of ASTM F1577-95b Detention Locks for Swinging Doors

1. Manufacturers:

- a. Sargent Manufacturing (SA) – 9200 Series.
- b. Brinks Locking (BR) - 1000 Series
- c. Southern Steel Mfg (SS) - 10500 Series

- B. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. 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. Corbin Russwin Hardware (RU) – ML2000 Series.
- b. Sargent Manufacturing (SA) – 8200 Series.
- c. Stanley Best (BE) – 40H-UN Series.

- C. Hurricane and Tornado Resistance Compliance: Mechanical locking and latching devices 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.

2.7 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

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

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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. High Security Monitoring: Provide lock bodies which have built-in request to exit monitoring and are provided with accompanying door position switches. Provide a resistor configuration which is compatible with the access control system.
4. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML20900 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Stanley Best (BE) - 40HW EL/EU Series.

2.8 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DL4100 Series.
 - b. Sargent Manufacturing (SA) - 4870 Series.
 - c. Stanley Best (BE) - 48H Series.

2.9 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.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. 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.
 2. 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.
 3. 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.
 4. 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.
 5. 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.
 6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 7. 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.
 8. 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.
 9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 13. 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.

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- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
- b. Sargent Manufacturing (SA) - 80 Series.
- c. Von Duprin (VD) - 35A/98 XP 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 including installation and adjusting information on inside of cover.
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. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. 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 physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Covers: Provide metal closer covers finished to match other hardware on the project.
8. 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.
9. Hurricane and Tornado Resistance Compliance: Door closers 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. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - DC8000 Series.

- b. Norton Door Controls (NO) – 9500 Series.
- c. Sargent Manufacturing (SA) - 281 Series.

2.12 ELECTROMECHANICAL DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
 - 1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
 - 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
 - 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19.
- F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Besam Automated Entrance Systems (BE) – SW200i Series.
 - 2. Horton Automatics (HO) - 4100 Series.
 - 3. Stanley Security Solutions (ST) - Magic Force Series.
 - 4. {Other}

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2.13 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 certified 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 Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.14 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 certified 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 Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

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- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified 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. Rixson Door Controls (RF).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Sargent Manufacturing (SA).

2.15 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. Hurricane and Tornado Resistance Compliance: Architectural seals 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.

- G. Manufacturers:

- 1. National Guard Products (NG).
 - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.16 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. Sargent Manufacturing (SA) – 3280 Series.
- b. Security Door Controls (SD) - DPS Series.
- c. Securitron (SU) - DPS Series.

- B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. 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.

1. Manufacturers:

- a. Sargent Manufacturing (SA) - 3500 Series.
- b. Security Door Controls (SD) - 630 Series.
- c. Securitron (SU) - BPS Series.

2.17 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.

2.18 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 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.

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- 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: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

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.

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- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:
1. MK - McKinney
 2. RF - Rixson
 3. SA - SARGENT
 4. AD - Adams Rite
 5. RO - Rockwood
 6. NO - Norton
 7. PE - Pemko
 8. OT - OTHER
 9. SU - Securitron

Hardware Sets

Set: 4.0

Doors: C160A, C161

Description: EXT ELEC - HM

3 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2" TXS-Stainless	US32D	MK	087100
1 Exit Device (storeroom)	36 WS 8804 ETP	US32D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Door Closer	MC 36 281 CPS	EN	SA	087100
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK - TORX	US32D	RO	087100
1 Threshold	271A MSES25SS Torx		PE	087100
1 Gasketing	S88D		PE	087100
1 Rain Guard	346C x LAR		PE	087100
1 Sweep	3452AV		PE	087100

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Set: 6.0

Doors: C162

Description: EXT SGL - MEP

3 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2" TXS-Stainless	US32D	MK	087100
1 Dormitory Lock	36 8225 LNP	US32D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Door Closer	MC 36 281 CPS	EN	SA	087100
1 Threshold	2715AK MSES25SS Torx		PE	087100
1 Gasketing	S88D		PE	087100
1 Rain Guard	346C x LAR		PE	087100
1 Sweep	3452AV		PE	087100

Notes: Hardware listed for design criteria, confirm with specific door manufacturer the hardware requirements to meet specified windstorm rating - Provide 3rd party test results for confirmation.

Set: 10.0

Doors: C159B

Description: PR - DE CORR - RATED

6 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2" TXS- Steel	US26D	MK	087100
2 Surface Vert Rod Exit, Exit Only	12 36 NB8710 EO	US32D	SA	087100
2 Door Closer	MC 36 281 CPS	EN	SA	087100
2 Kick Plate	K1050 10" X 2" LDW 4BE CSK - TORX	US32D	RO	087100
2 Door Stop	409 / 446 as equired - TORX	US26D	RO	087100
1 Gasketing	S88D		PE	087100
1 Astragal	355CS		PE	087100

Notes: Presenting a valid credential releases the lever to allow free entry, door relocks upon closing. REX (request to exit) switch in the lock allow for free exit at all times
Entry by key override at all times
Door is fail secure

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Set: 11.0

Doors: C160B

Description: SGL - LOCK - MEP

3 Hinge	TA2714 4-1/2" x 4-1/2" TXS-Steel	US26D	MK	087100
1 Storeroom Lock	36 8204 LNP	US26D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Door Closer	MC 36 281 Reg / PA	EN	SA	087100
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK - TORX	US32D	RO	087100
1 Door Stop	409 / 446 as equired - TORX	US26D	RO	087100
3 Silencer	608		RO	087100

Set: 18.0

Doors: C206

Description: SGL - EAC - SECURITY

3 Hinge (heavy weight)	T4A3786 SSF 4-1/2" x 4-1/2" TXS-Steel	US26D	MK	087100
1 Fail Secure Electric Lock	36 9271-24V LNP	US26D	SA	087100 ✗
1 Cylinder	DG2 as required	US32D	SA	087100
1 Door Stop	409 / 446 as equired - TORX	US26D	RO	087100
1 ElectroLynx Harness	QC-C1500 [PS to hinge]		MK	087100 ✗
1 ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	087100 ✗
1 Electric Power Transfer	EL-CEPT		SU	087100 ✗
1 Wiring Diagram	WD-SYSPK		SA	087100
1 Card reader	by security contractor		OT	
1 Position Switch	DPS-M/W-WH (as required)		SU	087100 ✗
1 Power Supply	BPS-Series (Volt & Amp as req)		SU	087100 ✗

Notes: Presenting a valid credential releases the lever to allow free entry, door relocks upon closing. REX (request to exit) switch in the lock allow for free exit at all times
Entry by key override at all times
Door is fail secure

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Set: 21.0

Doors: C100C, C101

Description: SGL - CHASE

3 Hinge	TA2714 4-1/2" x 4-1/2" TXS-Steel	US26D	MK	087100
1 Storeroom Lock	36 8204 LNP	US26D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Door Stop	409 / 446 as required - TORX	US26D	RO	087100
3 Silencer	608		RO	087100
1 Position Switch	DPS-M/W-WH (as required)		SU	087100 ↗

Notes: 4-SIDED FRAME - coordinate frame hardware with frame mfg

Set: 22.0

Doors: C205

Description: SGL - JAN

3 Hinge	TA2714 4-1/2" x 4-1/2" TXS-Steel	US26D	MK	087100
1 Storeroom Lock	36 8204 LNP	US26D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Kick Plate	K1050 4" X 1" LDW 4BE CSK - TORX	US32D	RO	087100
1 Door Stop	409 / 446 as required - TORX	US26D	RO	087100
1 Gasketing	S88D		PE	087100

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Set: 28.0

Doors: C103, C204

Description: SGL - STAFF TOILET - SECURITY

3 Hinge (heavy weight)	T4A3786 SSF 4-1/2" x 4-1/2" TXS-Steel	US26D	MK	087100
1 Entrance Lock	36 9245 LNP	US26D	SA	087100
1 Cylinder	DG2 as required	US32D	SA	087100
1 Conc Overhead Stop	1-X36 Torx	630	RF	087100
1 Kick Plate	K1050 4" X 1" LDW 4BE CSK - TORX	US32D	RO	087100
1 Gasketing	S88D		PE	087100
1 Coat Hook	RM811	US26D	RO	087100

Set: 32.0

Doors: C155

Description: SGL - TOILET

3 Hinge	TA2714 4-1/2" x 4-1/2" TXS- Steel	US26D	MK	087100
1 Privacy Lock	LB 36 49 8265 LNP	US26D	SA	087100
1 Kick Plate	K1050 4" X 1" LDW 4BE CSK - TORX	US32D	RO	087100
1 Door Stop	409 / 446 as equired - TORX	US26D	RO	087100
1 Gasketing	S88D		PE	087100

END OF SECTION 087100

SECTION 089000 - LOUVERS AND VENTS

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 with bird screens.
 - 2. Blank-off panels for louvers

- B. Related Sections:

- 1. Section 133419 "Metal Building Systems" for coordinating load transfer and installation details.
 - 2. Division 23 Section for louvers and grilles that are a part of mechanical equipment.
 - 3. Division 23 Section for ductwork and blank off panel(s) behind louver.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. 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.
- C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade shall pass enhanced protection, when tested according to AMCA 540.
- D. Hurricane Resistance: Provide louvers that meet the Hurricane Resistant Exterior Openings for the State of Florida including the High Velocity Hurricane Zones (HVHZ) requirements.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- F. 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.
- G. Intake Opening Protection: Air intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in louvers, grilles and screens shall be sized in accordance with Table 401.5 of the Florida Mechanical Code, and shall be protected against local weather conditions. Louvers that protect air intake openings in structures located in hurricane-prone regions, as defined in the Florida Building Code, Building, shall comply with AMCA 550. Outdoor air intake openings located in exterior walls shall meet the provisions for exterior wall openings protectives in accordance with the Florida Building Code, Building.
- H. Exhaust Opening Protection: Exhaust openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grilles shall be sized not less than 1/4 inch (6.4mm) and not larger than 1/2 inch (12.7 mm). Openings shall be protected against local weather conditions. Louvers that protect exhaust openings in structures located in hurricane-prone regions, as defined in the Florida Building Code, Building, shall comply with AMCA Standard 550. Outdoor openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the Florida Building Code, Building.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 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.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, 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. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 2. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

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

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory 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.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
- F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Vertical, Wind-Driven-Rain-Resistant, Windborne-Debris-Impact-Resistant Louver:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Greenheck Fan Corporation.
 - d. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: 6 inches (150 mm).
 - 3. Louver Size: Provide size required for minimum free area indicated on Drawings. Final configuration to be approved by Architect. Coordinate rough opening size and load transfer with Section 133419 "Metal Building Systems."
 - 4. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.095 inch (2.41 mm) for frames.
 - 5. Louver Performance Ratings:
 - a. Free Area: Not less than 5.95 sq. ft. (0.55 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 800-fpm (4.1-m/s) free-area exhaust and intake velocity.

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- c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s) at a core-area intake velocity of 969 fpm (5.0 m/s).
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
7. AMCA Rating: AMCA 540, AMCA 550.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Insect screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.5 BLANK-OFF PANELS

- A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
 2. Panel Finish: Same finish applied to louvers.
 3. Attach blank-off panels with clips.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.7 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: 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.
- 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 and vents 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. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be 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.

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents 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 and vents 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 089000

SECTION 090561 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.3 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Preinstallation testing reports.
- C. Field quality-control reports.

1.6 COORDINATION

- A. Coordinate MVE-Control system with floor covering manufacturers to assure complete system compatibility.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

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

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
 - 1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
 - 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
 - 1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F 1869.
 - 2. Relative Humidity: Maximum 100 percent when tested according to ASTM F 2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum 0.10 perm (5.75 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.

2.2 MVE-CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advanced Moisture Control, Inc.
 2. BASF Corporation.
 3. Custom Building Products.
 4. KOSTER American Corporation.
 5. LATICRETE SUPERCAP, LLC.
 6. MAPEI Corporation.
- B. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives. Coordinate selection of MVE-Control system with floor covering manufacturers.
1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
 2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of ~~3000-psi~~ (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.
2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.
 - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile required by MVE-control system manufacture and complying with ICRI 310.2R by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

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3.3 INSTALLATION

- A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
 - 1. Verify that surface preparation meets requirements.
 - 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
 - 3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.
- C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

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- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 090561

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board and cement board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior non-load-bearing wall studs; and exterior soffit framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports:

1. For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. Include ICBO test reports showing proposed hanger and bracing wire fasteners are capable of supporting specified loads.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Fire-Test-Response Characteristics:
- For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

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- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 20 gauge.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. 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 and as follows:
 - a. Minimum Base-Metal Thickness: 20 gauge.
 - b. Flange Width: 2-1/2 inch (63 mm).
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 16 gauge, unless otherwise indicated on Drawings.
- E. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.

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2. Chemical Anchor: Fabricated from corrosion-resistant materials, with allowable load or strength greater than or equal to the design load, as determined by testing conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.16 inch (4.12 mm)** in diameter.
 1. Diagonal Bracing Wire: 0.104 inch in diameter.
- D. Uplift Stiffeners: ASTM C 645 steel studs, minimum **0.0179 inch (0.455 mm)** thickness.
- E. Flat Hangers: Steel sheet, in size indicated on Drawings.
- F. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of **0.0538 inch (1.367 mm)** and minimum **1/2-inch- (13-mm-)** wide flanges.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Depth: **1-1/2 inch (38 mm)**.
- H. Resilient Furring Channels: **1/2-inch- (13-mm-)** deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: **0.053-inch (1.34-mm)** uncoated-steel thickness, with minimum **1/2-inch- (13-mm-)** wide flanges.
 1. Depth: **3/4 inch (19 mm)**.
 2. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.062-inch- (1.59-mm-)** diameter wire, or double strand of **0.048-inch- (1.21-mm-)** diameter wire.
- J. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock for both interior and exterior applications.
 1. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. **Armstrong World Industries, Inc;** Drywall Grid Systems.
 - b. **Chicago Metallic Corporation;** 640/660 Drywall Ceiling Suspension.
 - c. **United States Gypsum Company;** Drywall Suspension System.
 2. Accessories: Compression posts for exterior applications.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

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

- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

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 (1219 mm) o.c.
 - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
 - 3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- 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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
 - 9. Install 4 way 45 degree diagonal bracing wires at 12' 0" x 8' 0" within 6-inches of walls. Diagonal bracing wires shall be located at the intersection of main runner and cross-furring member. Provide connection between diagonal wires and main runner so as to prevent slipping for a 200-pound approximate seismic load.
 - 10. Install hanger and bracing wire anchors so the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
 - 11. Separate ceiling hanging and bracing wires at least 6-inches from unbraced ducts, pipes, and conduit.

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12. Install uplift stiffener for each 96-square feet of ceiling, consisting of a vertical metal stud occurring at the junction of the carrier and furring channel. Wire tie to carrier or screw to channel and secure to overhead structure.
 13. Provide recesses and openings where indicated for lighting fixtures, registers, access panels, and other items to be installed in ceilings; provide additional furring channels where required by opening.
 14. Recessed or drop-in light fixtures shall be supported directly by main runners or by supplemental framing which is supported by main runners.
 15. Surface mounted fixtures shall be attached to a main runner with a positive clamping device made of material with a minimum of 14-gauge. Rotational spring catches are not acceptable.
- 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** (3 mm in 3.6 m) 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 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 057513 "Security Wire Mesh" for security wire mesh installed behind gypsum board.
2. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in **12-inch-** (300-mm-) long length for each trim accessory indicated.

1.3 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.

1.4 FIELD CONDITIONS

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

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2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. CertainTeed.
 2. National Gypsum Company.
 3. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch (15.9 mm).
 2. Long Edges: Tapered.
- C. Moisture-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 1. Core: 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.
- D. Very-High-Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
 1. Core: 5/8 inch (15.9 mm), Type X with fiberglass mesh reinforcement.
 2. Surface Abrasion: Meets or exceeds Level 2 requirements.
 3. Surface Indentation: Meets or exceeds Level 1 requirements.
 4. Single-Drop Soft-Body Impact: Meets or exceeds Level 3 requirements.

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5. Hard-Body Impact: Meets or exceeds Level 3 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 CEMENTITIOUS PANELS

- A. Cementitious Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch (15.9 mm) thick.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch (15.9 mm) thick.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized-steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound. Use unless otherwise indicated.
 - c. LK-Bead with square nose for use with kerfed joints.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - 1) One-piece control joint formed with vee-shaped slot per Fig. 1 in ASTM C 1047, with slot opening covered with removable strip.

2.7 JOINT TREATMENT MATERIALS

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

- B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

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- 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. 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.
 - 2. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 3. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 4. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from **0.033 to 0.112 inch** (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Acoustical Tape: Closed cell 1/4 inch minimum thickness, or thicker as detailed, preformed PVC foam tape, adhesive backed.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide product by one of the following Manufacturers or comparable product by approved Manufacturer:
 - a. Lamatek; PVC Foam Tape.
 - b. MBK Tape Solutions; MBK 4525.
 - c. Saint-Gobain, Norseal V730.
 - d. Or equal.

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- E. Acoustic Sealant Pads: Resilient pads, composed of polybutene-butyl and inert fillers.
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following Manufacturers or comparable product by approved Manufacturer:
 - a. Lowry's, Inc. dba Kirwan Corp.; Lowry Outlet Box Pads.
 - b. Trademark Soundproofing; Acoustical Outlet Baker Putty Pad.
 - c. West Coast Sound Solutions; Sealtight Acoustical Putty Pads.
 - d. Or equal.
- F. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following Manufacturers or comparable product by approved Manufacturer:
 - a. GE Construction Sealants; Mumentive Performance Materials Inc.
 - b. Pecora Corporation.
 - c. Tremco Incorporated.
 - d. USG Corporation.
 - e. Or equal.
 2. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Acoustical Gaskets: Closed-cell neoprene rubber, black, 12 pcf density, thickness as indicated.
1. Manufacturers: Subject to compliance with requirements, provide product by one of the following Manufacturers or comparable product by approved Manufacturer:
 - a. Lamatek; SCE-45B.
 - b. SoundAway; NeoGasket.
 - c. Williams Products, Inc.; 1040 Series, Type NN1.
 - d. Or equal.
- H. Acoustic 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 support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch (1.5 mm)** of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft. (0.7 sq. m)** in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow **1/4- to 3/8-inch- (6.4- to 9.5-mm-)** wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide **1/4- to 1/2-inch- (6.4- to 12.7-mm-)** wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

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- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLING SECURITY WIRE MESH

- A. Attach to framing members using manufacturer's security clips and self-tapping screws. See Section 057513 "Security Wire Mesh."

3.4 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:

- 1. Type X: Unless otherwise indicated.
- 2. Very-High-Impact-Resistant Type: As indicated on Drawings.

- B. Single-Layer Application:

- 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
- 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On 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 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.
- 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.5 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated on Drawings.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 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, according to ASTM C 840, in specific locations approved by Architect for visual effect, and complying with the following:
 - 1. Ceilings:
 - a. Install control joints in areas exceeding 2,500 sq. ft. (232 sq. m).
 - b. Space control joints not more than 50 feet (15.2 m) o.c.
 - 2. Walls:
 - a. Install control joints in areas exceeding 250 sq. ft. (23.2 sq. m).
 - b. Space control joints not more than 30 feet (9.1 m) o.c.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use unless otherwise indicated.
 - 3. LK-Bead: Use at kerfed joints.
 - 4. L-Bead: Use where indicated.
 - 5. U-Bead: Use where indicated.

3.7 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.

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D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
2. Level 2: Panels that are substrates for tile, and where indicated.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
4. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.8 PROTECTION

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

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, **6 inches (150 mm)** in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of **6-inch- (150-mm-)** square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of **6-inch- (150-mm-)** long Samples of each type, finish, and color.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Perimeter moldings.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Sprinklers.
 - d. Access panels.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.

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- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL PANELS APC-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Optima Open Plan 3250 or a comparable product by one of the following:
 - 1. United States Gypsum Company; Halcyon ClimaPlus No. 98223.
 - 2. Or equal.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 - 2. Pattern: E (lightly textured).
- C. Color: White.
- D. LR: Not less than 0.90.
- E. NRC: Not less than 0.95.
- F. Edge/Joint Detail: Square tegular.
- G. Thickness: 1 inch (25 mm).
- H. Modular Size: 24 by 24 inches (610 by 610 mm).
- I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 ACOUSTICAL PANELS APC-3

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Optima Open Plan 3252 or a comparable product by one of the following:
1. United States Gypsum Company; Halcyon ClimaPlus No. 98243.
 2. Or equal.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 2, cloth. Binder shall not contain urea formaldehyde.
 2. Pattern: E (lightly textured).
- C. Color: White.
- D. LR: Not less than 0.90.
- E. NRC: Not less than 0.95.
- F. Edge/Joint Detail: Square tegular.
- G. Thickness: 1 inch (25 mm).
- H. Modular Size: 24 by 48 inches (610 by 1220 mm).
- I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

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- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
 2. 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 hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than ~~0.106-inch-~~ (2.69-mm-) diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Security Hold-Down Clips: Where indicated, provide manufacturer's security hold-down clips.

2.5 METAL SUSPENSION SYSTEM

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than ~~G30~~ (Z90) coating designation; with prefinished ~~15/16-inch-~~ (24-mm-) wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.

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8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 9. Space hangers not more than **48 inches (1200 mm)** o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than **8 inches (200 mm)** from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than **16 inches (400 mm)** o.c. and not more than **3 inches (75 mm)** from ends, leveling with ceiling suspension system to a tolerance of **1/8 inch in 12 feet (3.2 mm in 3.6 m)**. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
 6. Install acoustical insulation over acoustical panels in areas indicated as recommended by panel manufacturer's written instructions.

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3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Compliance of seismic design.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
 - 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

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

END OF SECTION 095113

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Plastic (PVC).
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 2. Section 055119 "Metal Grating Stairs" for shop priming metal grating stairs.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.

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2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 1. Benjamin Moore & Co.
 2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 3. Kelly-Moore Paint Company Inc.
 4. Sherwin-Williams Company (The).

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2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
 - 1. Comparable products not listed in the "MPI Approved Products Lists" may be recommended for the Architect's consideration. Provide documentation to Architect that demonstrates comparability and compliance with requirements.
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Portland Cement Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

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- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Plastic Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

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- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

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

3.6 EXTERIOR PAINTING SCHEDULE

- A. Steel and Iron Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
- B. Galvanized-Metal Substrates:
 - 1. Latex System MPI EXT 5.3H:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

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C. Plastic Substrates:

1. Latex System MPI EXT 6.8A:

- a. Prime Coat: Primer, bonding, water based, MPI #17.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
 - 4. Section 055119 "Metal Grating Stairs" for shop priming metal grating stairs.
 - 5. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
 - 6. Section 099600 "High-Performance Coatings."

1.2 DEFINITIONS

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

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1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Cell Door: Including painted identification.
 - c. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. P-1, P-2, P-3: Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 - 3. Kelly-Moore Paint Company Inc.
 - 4. Sherwin-Williams Company (The).
- B. Concrete Floor Sealer Products: CHS
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Euclid Chemical Company; Euco Diamond Hard or one of the following:
 - a. Curecrete Distribution, Inc.
 - b. Degusa Building Systems
 - c. Kryton Canada Corporation.
 - d. Or equal.
- C. Concrete Wall Sealer Products: SLR
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Euclid Chemical Company; Euco Diamond Clear or one of the following:
 - a. Curecrete Distribution, Inc.
 - b. Degusa Building Systems
 - c. Kryton Canada Corporation.
 - d. Or equal.

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2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
 - 1. Comparable products not listed in the "MPI Approved Products Lists" may be recommended for the Architect's consideration. Provide documentation to Architect that demonstrates comparability and compliance with requirements.
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors: Use of manufacturer's proprietary product names to designate colors is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
 - 1. Refer to Room Finish Schedule on Drawings for color selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

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- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 - 4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- F. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or

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unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

- G. Second and Third Coats: Two individual finish coats are required, for a total of three coats (minimum). First coat is the primer; second and third coats are referred to in the schedule that follows in Part 3 as the “Intermediate” and “Top” coats. “Backrolling” is not an acceptable method of providing the top coat. Apply each coat so that it completely covers the entire surface being painted and allow it to dry before applying the next coat.
- H. Touch-Ups: Touch-up painting to include painting of entire surface, corner to corner. Spot touch-up not allowed.
- I. Painting Structural Steel Work:
 - 1. Paint primed structural steel to be permanently enclosed or concealed in the completed Work with a second prime coat. Use material compatible with first coat primer.
- J. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces and spaces scheduled to be painted:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

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

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Latex System MPI INT 3.1A (Ceilings):
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
 - 2. Latex System MPI INT 3.1A (Walls):
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.
 - 3. Water-Based Concrete Sealer System (Wall, dormitory cell concrete bench tops and sides):
 - a. Topcoat: SLR; Clear sealer, water based, for concrete.
- B. Concrete Substrates, Traffic Surfaces:
 - 1. Water-Based Concrete Sealer System:
 - a. Topcoat: CHS; Clear sealer, water based, for concrete floors.
 - 2. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.
 - a. Color: As indicated.

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C. CMU Substrates:

1. Latex System MPI INT 4.2A:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

D. Steel Substrates:

1. Primed Structural Steel to be Concealed by Completed Work:
 - a. First Prime Coat: Shop primed (per Section 051200).
 - b. Second Prime Coat: Field applied rust inhibitive, water based primer, MPI #107.
2. Water-Based Light Industrial Coating System MPI INT 5.1B:
 - a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 3), MPI #151.

E. Gypsum Board Substrates:

1. Latex over Latex Sealer System MPI INT 9.2A (Ceilings and soffits):
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
2. Latex over Latex Sealer System MPI INT 9.2A (Walls):
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 4), MPI #43.

END OF SECTION 099123

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Interior Substrates:
 - a. Concrete, vertical surfaces.
 - b. Concrete masonry units (CMUs).
 - c. Steel.
 - d. Galvanized metal.

1.2 DEFINITIONS

- A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design, Interior Substrates: Subject to compliance with requirements, provide Tnemec Inc. product listed in the Interior High-Performance Coating Schedule for the coating category indicated or a comparable product by one of the following:
 - 1. Carboline.
 - 2. Sherwin Williams.
 - 3. Or equal.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.

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- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.
 - 5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 6. Pretreatment Wash Primers: 420 g/L.
- D. Colors: Use of manufacturer's proprietary product names to designate colors is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
 - 1. Refer to Room Finish Schedule on Drawings for color selections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

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- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10 350 to 27 580 kPa) at 6 to 12 inches (150 to 300 mm).
 - 2. Allow new concrete to cure for 14 days.
 - 3. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10 350 to 27 580 kPa) at 6 to 12 inches (150 to 300 mm).
 - 2. Allow mortar to cure for 14 days. Level protrusions and mortar spatter.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

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4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

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

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE EP-1

- A. Concrete Substrates, Vertical Surfaces:
 1. Epoxy System:
 - a. Prime / Filler Coat: Epoxy, Waterborne Cementitious Acrylic Masonry Filler:
 - 1) Basis-of-Design: Thiemec Series 130 Envirofill.

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- b. Intermediate Coat: Inorganic Hybrid Water-Based Epoxy, low VOC:
 - 1) Basis-of-Design: Tnemec Series 27WB Typoxy.
 - a) Dry Film Thickness: 5.0-7.0 mils per coat.
 - c. Topcoat: Epoxy, Ceramic-Modified Waterborne Aliphatic Polyurethane, low VOC:
 - 1) Basis-of-Design: Tnemec Series 297, Enviro-Glaze.
 - a) Dry Film Thickness: 2.0-3.0 mils per coat.
- B. CMU Substrates:
- 1. Epoxy System:
 - a. Prime / Filler Coat: Epoxy, Waterborne Cementitious Acrylic Masonry Filler:
 - 1) Basis-of-Design: Tnemec Series 130 Envirofill.
 - b. Intermediate Coat: Inorganic Hybrid Water-Based Epoxy, low VOC:
 - 1) Basis-of-Design: Tnemec Series 27WB Typoxy.
 - a) Dry Film Thickness: 5.0-7.0 mils per coat.
 - c. Topcoat: Epoxy, Ceramic-Modified Waterborne Aliphatic Polyurethane, low VOC:
 - 1) Basis-of-Design: Tnemec Series 297, Enviro-Glaze.
 - a) Dry Film Thickness: 2.0-3.0 mils per coat.
- C. Steel Substrates, Architectural Exposed Steel Surfaces:
- 1. Epoxy System:
 - a. Primer: Aromatic Urethane, Zinc-Rich, for Metal.
 - 1) Basis-of-Design: Tnemec; Series 94-H₂O Hydro-Zinc.
 - a) Dry Film Thickness: 2.5-3.5 mils per coat.
 - b. Intermediate Coat: Inorganic Hybrid Water-Based Epoxy, low VOC:
 - 1) Basis-of-Design: Tnemec Series 27WB Typoxy.
 - a) Dry Film Thickness: 5.0-7.0 mils per coat.

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- c. Topcoat: Epoxy, Ceramic-Modified Waterborne Aliphatic Polyurethane, low VOC:

- 1) Basis-of-Design: Tnemec Series 297, Enviro-Glaze.

- a) Dry Film Thickness: 2.0-3.0 mils per coat.

D. Galvanized-Metal Substrates, Architectural Exposed Steel Surfaces:

1. Epoxy System:

- a. Primer: Inorganic Hybrid Water-Based Epoxy, low VOC.

- 1) Basis-of-Design: Tnemec Series 27WB Typoxy.

- a) Dry Film Thickness: 5.0-7.0 mils per coat.

- b. Intermediate Coat: Inorganic Hybrid Water-Based Epoxy, low VOC:

- 1) Basis-of-Design: Tnemec Series 27WB Typoxy.

- a) Dry Film Thickness: 5.0-7.0 mils per coat.

- c. Topcoat: Epoxy, Ceramic-Modified Waterborne Aliphatic Polyurethane, low VOC:

- 1) Basis-of-Design: Tnemec Series 297, Enviro-Glaze.

- a) Dry Film Thickness: 2.0-3.0 mils per coat.

END OF SECTION 099600

SECTION 099656 – EPOXY COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following resinous wall, ceiling, and flooring systems:
 - 1. SES-1: Seamless Shower System, integrated spray applied system for floors, walls and ceilings consisting of 100% solids accelerated aliphatic amine cured epoxy with chopped strand fiberglass and Kevlar® reinforcement, and an integrated anti-microbial topcoat system.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Meeting: Prior to the installation of the seamless system, meeting shall be held at the project site with the manufacturer's representative, the installer, the engineer/architect, and the Owner's representative. Record discussions and furnish a copy to each participant. Topics to be discussed shall include, but not be limited to:
 - 1. Planned start and completion timing for each mobilization.
 - 2. Safety procedures.
 - 3. Coordination of other trades in area.
 - 4. Existing and new slab conditions.
 - 5. Slab testing results.
 - 6. Existing wall substrate conditions.
 - 7. Surface preparation.
 - 8. Required room temperatures.
 - 9. Ventilation.
 - 10. Step by step installation procedures.
 - 11. Curing time and methods.
 - 12. Protection of completed work.
 - 13. Review of performance requirements including chemical abuse, effluent temperature, type, size, and weights of vehicular and static loads.

1.4 SUBMITTALS

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

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1. Include manufacturer's technical data, application instructions, and recommendations for each product component.
- B. Shop Drawings:
 1. Provide floor plans to scale matching Architectural Plans, indicating extent of each resinous floor/wall system, including type, color and pattern, degree of slip-resistance, and dimensioned locations of control joints, seams, divider strips [if applicable], and terminations.
 2. Provide enlarged details indicating terminations at walls, door frames, pits, curbing, etc.
- C. Samples: For each resinous system required, provide a 3 by 3 inch (76 by 76 mm) sample applied to a rigid backing.
- D. Installer Certificates: Signed by manufacturer, certifying that installer complies with specified requirements.
- E. References: Manufacturer shall submit a list of ten (10) projects of similar size and complexity as this project in which their certified installer has successfully completed. Each reference must include the following:
 1. Project name and address
 2. Job size
 3. General scope of work
 4. Systems installed which match substitutions to the basis of design products.
 5. Verification that the key personnel who will be doing the installing are the same personnel who have successfully installed the 10 projects of similar size and scope.
 6. Owner's names and contact phone numbers for each of the 10 projects submitted.
- F. Warranties: Special warranties specified in this Section.
- G. Maintenance Data: For seamless epoxy system to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is experienced in applying the resinous system specified herein.
- B. Submittal shall include a letter of training certification from the manufacturer stating that the installer is approved and experienced to apply each system specified in this section. Letters of certification must prove that the bidder has received separate certification in each coating system specified for this project including, training/certification in installing 100% solids aggregate reinforced epoxy flooring, 100% solids trowel/slurry applied urethane mortar flooring, 100% solids spray applied fiberglass reinforced wall systems, and 100% solids fiberglass and aggregate reinforced seamless shower systems as specified. Contractors lacking the required certifications shall be disqualified from bidding the work herein.
- C. Submit written description of installer's experience with specified material over the last 5 years, including job sizes and complexity. List a minimum of 10 projects including Owner's names

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and phone numbers. Project list must be for projects include all required surface preparation and the installation of specified or equal systems including installing 100% solids epoxy and urethane flooring systems and spray applied fiberglass reinforced seamless systems as specified. Include owner's names and phone numbers for verification. Failure to provide the above will result in contractor's bid being disqualified.

- D. Source Limitations: Obtain all resinous flooring materials, including waterproofing membranes, grouts, resins, curing agents, grout coats, aggregates, topcoats, patching and fill material, joint sealants, and repair materials from a single Manufacturer.
- E. Manufacturer Field Services: The installer of the coating system shall contact the material manufacturer during the bidding phase of the project and shall include in the cost of this work, the cost of manufacturer's field engineering services as specified below.
 - 1. Material Manufacturer shall be responsible for the review of the project conditions that may impact product performance before product installation, including but not limited to project climate, acceptable temperature of substrate and air, acceptable humidity levels of air, acceptable moisture content of substrates to be coated, surface preparation, and all other conditions that are necessary for optimum product performance. The manufacturer's field engineer shall document and verify that all conditions are acceptable prior to commencement of work.
 - 2. The manufacturer's field representative shall submit through the Contractor written approvals of the proposed coating system including manufacturer's recommended applicator, manufacturer's recommended application procedures, and manufacturer's recommended surface preparation.
 - 3. The materials manufacturer's representative must be present on site for the pre-installation site conditions evaluation, for the duration of the surface preparation and for all phases of the installation of the specified resinous coating system. Installer's bid shall include the cost of the manufacturer's field services as specified above.
- F. Mockup:
 - 1. Build mockups to verify selections made from sample materials and to set quality standards for materials and execution.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - 3. Apply full thickness mockups on a minimum of a 48 by 48 inch (1219 by 1219 mm) section of flooring integrated with a 48 by 48 inch (1219 by 1219 mm) section of wall.
 - 4. If a cove base is to be included on the project, mockup shall include same.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials in a location to prevent deleterious effects from sunlight, moisture, excessive heat, or cold.

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- C. Storage of materials shall comply with all fire and safety regulations

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application including the following:

- 1. Maintain ambient air temperature between 65°F and 85°F.
 - 2. Concrete substrate shall be properly cured for a minimum of 30 days.

- B. Conditions of Substrates:

- 1. Floor slabs: Concrete must be clean, sound free of surface contaminants and meet all requirements as outlined in Part 3 Execution.
 - 2. Walls:
 - a. Concrete Masonry Unit CMU:
 - 1) Mortar joints are struck clean and filled tightly to avoid gaps or holes providing a neat, uniform appearance in accordance with procedures as outlined under Division 4 - "Masonry".
 - 2) All mortar spatter shall be removed, including protruding mortar edges, and other excessive mortar.
 - 3) All rough edges shall be ground smooth.
 - 4) All surfaces shall be clean, dry and free of contaminants prior to installing coating system.
 - b. Cement Board: Boards shall be installed with minimal gaps between boards and edges. Where high performance 100% solids fiberglass reinforced coatings are to be installed, the finishing/filling/taping of joints shall be done by the coatings installer with 100% solids epoxy patching compound and reinforcing fiberglass mesh tape. Joint compound and standard taping procedures not acceptable. Cement board shall be installed with the rough side facing out to promote optimum adhesion of the coating system. All surfaces shall be clean and dry, and free of contaminants prior to installing coating system.
 - c. Concrete Walls and Ceilings: All surfaces shall be clean, dry and free of contaminants. Areas containing imperfections such as pinholes, recesses, holes, etc. shall be pre-patched or filled in accordance with manufacturer's recommendations prior to installing the specified system.

- C. Lighting: Proper lighting is required for installation. When possible lighting shall simulate permanent lighting conditions during resinous floor/wall application.
- D. Close spaces to traffic during resinous coatings application and for not less than 48 hours after application, unless manufacturer recommends a longer period.
- E. Airborne contamination: Resinous systems shall not be applied in areas where dust or other airborne particulate matter is being generated.

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1.8 WARRANTY

- A. Manufacturer alone shall furnish a single, written warranty covering 100% of the material and labor costs protecting the Owner from delamination and product failure caused by defective product or defective installation for a period of 1 year from date of installation. Provide separate manufacturer's written warranty covering 100% of the material and labor costs protecting the Owner from delamination and product failure caused by defective product or defective installation for a period of 5 years for SC-4 Seamless Shower System 5130. Joint warranties between manufacturer and installer not accepted.
 - 1. Extent of warranty shall be limited to the repair or replacement of defective surfaces at no cost to the Owner. The warranty shall not include any remedy for defects caused by abuse, improper maintenance, and change of use or operation, moisture migration from the back side of coating system or by normal wear, tear and usage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Basis of Design: Seamless epoxy system indicated has been selected for both its aesthetic and performance characteristics. Any proposed substitution of this product must meet or exceed the characteristics of the indicated product in both appearance and all aspects of product performance, as determined and approved by Architect.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Primecoat Coating Systems.
 - b. Or equal.

2.2 COLORS

- A. Colors: Use of manufacturer's proprietary product names to designate colors is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
 - 1. Refer to Room Finish Schedule on Drawings for color selections.

2.3 SYSTEMS

- A. SC-2: Resinous Urethane Flooring System with integrated cove base and consisting of 100% solids urethane slurry mixture and broadcasting aggregate with pigmented Novolac heat resistant finish and an integrated anti-microbial finish. Basis of Design Product: "Prime Cast 2410" as manufactured by Prime Coat Coating Systems.
 - 1. Acceptable Alternates: must be equal or superior to "basis of design" product in chemical

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composition, thickness, and level of reinforcement and pre-approved a minimum of 10 days prior to bid date.

2. System Characteristics:
 - a. Color and Pattern: As selected by Owner from manufacturer's full range.
 - b. Wearing Surface: Textured for slip-resistance per Owner selection from manufacturer's full range.
 - c. Integral Cove Base: Cant or radius, as selected by the Architect.
 - d. System Thickness: minimum 3/16th inch. Note: A 1/8th inch slurry with reinforcing mesh is required under hot pot areas prior to installing the 3/16th inch slurry broadcast system.
 - e. VOC's: less than 8 g/l.
3. System Components: Manufacturer's standard components which are compatible with each other as follows:
 - a. Basecoat:
 - 1) Product: PC 352 Cretecoat SL
 - 2) Resin: urethane
 - 3) Application method: Slurry/Broadcast
 - 4) Minimum installed thickness: 3/16th inch with broadcast
 - 5) Type: pigmented
 - b. Broadcast:
 - 1) Product: PCA 331 aggregate
 - 2) Application: broadcast to rejection
 - c. Topcoat:
 - 1) Product: PC 421 with PC 499 anti-microbial
 - 2) Resin: novolac epoxy
 - 3) Application method: roller
 - 4) Minimum installed thickness: 16-20 mils
 - 5) Type: pigmented
 - 6) Number of coats: 1
4. Performance Requirements:
 - a. Resinous flooring shall withstand chemical attack by agents in temperatures and concentrations stated therein.
 - 1) Hot grease.
 - 2) Hot oil.
 - 3) Hot water.
 - 4) Acidic chemicals.
 - b. Resinous flooring shall normal use in commercial kitchen.
 - c. Physical/Chemical Characteristics:

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- 1) Compressive Strength: 8,400 psi after 7 days (ASTM C-579)
 - 2) Tensile Strength: 1,100 psi (ASTM C-307)
 - 3) Flexural Strength: 2,300 psi (ASTM C-580)
 - 4) Flexural Modulus of Elasticity: 1.7×10^5 (ASTM D-790)
 - 5) Abrasion Resistance: .05 gm loss, 1000 gm load, 1000 cycles (ASTM D4060/CS-17)
 - 6) Hardness: 75-80 (ASTM D-2240/Shore D Durometer)
 - 7) Bond Strength: >400 psi (100% concrete failure)
 - 8) Indentation: No indentation (MIL-D-3134F)
 - 9) Flammability: Self extinguishing (ASTM E648) Extent of burning 0.25
 - 10) Service Temperature: -100°F to 220°F (-73°C to 104°C)
 - 11) All products must be 100% solids with zero VOC's.
 - 12) Final finish shall include integrated anti-microbial that protects against the following:
 - a) FUNGI BACTERIA, *Alternaria tenuis* *Aerobacter aerogenes*, *Alternaria brassiciola* *Bacillus cereus*, *Aspergillus clavatus* *Bacillus subtilis*, *flavus* *Desulfovibrio desulfuricans*, *niger* *Ecterobacter* sp., *oryzae* *Klebsiella pneumoniae*, *terreus* *Lactobacilli* sp., *ustus* *Micrococcus* sp., *versicolor* *Proteus* sp., *Aureobasidium* (*Pullularia*) *pullulans* *Pseudomonas aeruginosa*, *Candida guilliermondii* *S. typhimurium*, *lipolytica* *S. typhosa*, *pelliculosa*, *Salmonella choleraesuis*, *tropicalis* *Shigella* sp., *Chaetomium globosum* *Staphylococcus aureus*, *Cladosporium resinae* *Staphylococcus epidermidis*, *Epidermophyton* sp. *Streptococcus faecalis*, *Helminthosporium gramineum* *Streptococcus pyogenes*, *Memnoniella echinata*, *Mucor racemosus*.
 - b) ACTINOMYCETES, *Mytothecium verrucaria*, *Streptomyces rubrircetuli*, *Penicillium citrinum*, *Streptoverticillium reticulum*, *Penicillium islandueum*, *Thermoactionomyces vulgaris*, *expansum*, *funiculosum*, *lilacinum*, *luteum*, *piscarium*, *variabile*, *Rhizopus nigricans*, *Scopulariopsis brevicaulis*, *Spicaria violacea*, *Trichophytonmentagrophytes*.
- B. SC-5: Seamless Shower, integrated system for floors, walls and ceilings consisting of 100% solids accelerated aliphatic amine cured epoxy with chopped strand fiberglass and Kevlar® reinforcement, and an integrated Anti-microbial Glaze topcoat system. Basis of Design: "Seamless Shower System 5130", as manufactured by Prime Coat Coatings Systems.
1. Acceptable Alternates: must be equal or superior to "basis of design" product in chemical composition, thickness, and level of reinforcement and pre-approved a minimum of 10 days prior to bid date.
 2. System Components: Manufacturer's standard components which are compatible with each other as follows:
 - a. Primer for Wall and Ceiling Surfaces:
 - 1) Resin: 100% solids plural component thixotropic epoxy
 - 2) Product: PC 630
 - 3) Application method: spray, roller, or brush

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- 4) Installed thickness: 6-8 mils over concrete and non-porous surfaces; 12-20 mils over CMU
 - 5) Number of coats: 1
 - b. Floor Base Coat:
 - 1) Resin: 100% solids plural component Bisphenol A epoxy
 - 2) Product: PC 310 with broadcasting aggregate PCA 322
 - 3) Application method: broadcast silica
 - 4) Installed thickness including aggregate: 40 mils
 - 5) Type: clear
 - 6) Number of coats: 1
 - c. Body Coat Floor Walls and Ceilings:
 - 1) Resin: 100% solids Fiberglass and Kevlar reinforced epoxy
 - 2) Product: PC 200
 - 3) Application method: 45:1 air-powered airless spray w/gravity-fed hopper
 - 4) Reinforcement: Chopped strand fiberglass and Kevlar®
 - 5) Installed thickness: 45 mils minimum
 - 6) Type: pigmented
 - 7) Number of coats: 1
 - d. Top Coat All Surfaces
 - 1) Resin: 100% solids Bisphenol A chemically resistant epoxy
 - 2) Product: PC 400 with PC 499 anti-microbial
 - 3) Application method: roller or spray
 - 4) Minimum installed thickness: 8 - 10 mils
 - 5) Antimicrobial: integrated into topcoat
 - 6) Type: pigmented
 - 7) Floor Finish: Must meet ADA requirements. PCA 337 slip resistant aggregate to be added to floor topcoat to achieve proper slip resistant texture.
3. System Characteristics/Performance Requirements:
 - a. Color and Pattern: As selected by Owner from manufacturer's full range.
 - b. Wearing Floor Surface: Textured for slip-resistance per Owner selection from manufacturer's full range.
 - c. Cove Base: 2 inch Cant-styled.
 - d. System Thickness: Walls: 60 mils minimum. Floors: 1/8th inch minimum.
 - e. VOC's: in compliance with EQ 4.2, less than 100 g/l.
 - f. Product Composition: Wall Systems must be spray applied 100% solids with Fiberglass and Kevlar strands premixed into both the Part A and Part B epoxy components. Fiberglass and Kevlar Strands must be sufficient enough to form a reinforced matrix/web within the resin providing increased tensile strength and impact resistance and high build characteristics as specified.
 - g. Compressive Strength Minimum: 11,700 p.s.i. (ASTM D-695-77)
 - h. Tensile Strength Minimum: 3,900 p.s.i. (ASTM D-638-77a)

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- i. Hardness minimum: 83-88 (ASTM D-2240/Shore D Durometer.
- j. Abrasion Resistance Minimum: 0.03 gm/1000 revolutions (ASTM D-4060 Taber Abrader.)
- k. High or Low Solids solvent based and all water based systems excluded.
- l. Fiberglass Mat layup systems excluded.
- m. Roller Applied systems excluded.
- n. Systems less than 60 mils for walls and 1/8th inch for floors excluded.
- o. Final finish shall include integrated anti-microbial that protects against the following:
 - 1) FUNGI BACTERIA, *Alternaria tenuis* *Aerobacter aerogenes*, *Alternaria brassiciola* *Bacillus cereus*, *Aspergillus clavatus* *Bacillus subtilis*, *flavus* *Desulfovibrio desulfuricans*, *niger* *Ecterobacter* sp., *oryzae* *Klebsiella pneumoniae*, *terreus* *Lactobacilli* sp., *ustus* *Micrococcus* sp., *versicolor* *Proteus* sp. *Aureobasidium* (*Pullularia*) *pullulans* *Pseudomonas aeruginosa*, *Candida guilliermondii* *S. typhimurium*, *lipolytica* *S. typhosa*, *pelliculosa*, *Salmonella choleraesuis*, *tropicalis* *Shigella* sp., *Chaetomium globosum* *Staphylococcus aureus*, *Cladosporium resinae* *Staphylococcus epidermidis*, *Epidermophyton* sp. *Streptococcus faecalis*, *Helminthosporium*, *gramineum* *Streptococcus pyogenes*, *Memnoniella echinata*, *Mucor racemosus*.
 - 2) ACTINOMYCETES, *Myrothecium verrucaria*, *Streptomyces rubroreticuli*, *Penicillium citrinum*, *Streptovercillium reticulum*, *Penicillium islandicum*, *Thermoactinomyces vulgaris*, *expansum*, *funiculosum*, *lilacinum*, *luteum*, *piscarium*, *variable*, *Rhizopus nigricans*, *Scopulariopsis brevicaulis*, *Spicaria violacea*, *Trichophyton mentagrophytes*.

2.4 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of resinous flooring manufacturer.
- B. Joint Sealants: Formulated by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification: Verify that all substrate and environmental conditions are in compliance with requirements discussed during Pre-installation conference.
- B. Mandatory Testing of Floor Slabs:
 - 1. Prior to the installation of flooring, it is mandatory that all surfaces are tested for moisture content, pH, and alkalinity levels that would be detrimental to the adhesion of coating materials. For tests to be accurate, temperatures and humidity levels should be stabilized for a minimum of 72 hours. NOTE: TESTING PERFORMED BY ANY METHOD IN UNCONDITIONED SPACES WILL NOT YIELD CONSISTENT RESULTS. Tests

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below must be completed in accordance with documented Test Methods:

- a. Calcium Chloride Tests per ASTM F 1869
 - b. Relative Humidity [in situ] Testing per ASTM F 2170
 - c. Others as required by manufacturer or unique job conditions. If additional testing is required, additional costs may be incurred by owner.
2. Do not proceed with installation if moisture levels exceed 5% or 3 lbs. per 1,000 sf per 24 hours or if ambient temperature is less than 5°F above dew point unless approved by material manufacturer.

C. Testing Activities During Resinous Coating Application

1. Material Sampling: Owner's representative may at any time and any number of times during resinous coating application require the Owner's independent testing agency to collect material samples for testing for compliance with requirements.
 - a. Material samples will be taken, identified, sealed, and certified in presence of Installer.
 - b. Testing agency will test samples for compliance with requirements at the cost to the owner, using applicable referenced testing procedures in addition to testing procedures listed in manufacturer's product data.
2. If test results show applied materials do not comply with specified requirements, Installer shall correct all deficiencies of coating system in a method and manner acceptable to the manufacturer's recommendations.

D. Notify the General Contractor immediately upon determination that surfaces scheduled to receive coating are unacceptable for proper adhesion or subsequent performance.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with surface preparation or coating application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrates in accordance with manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral pH substrate for resinous floor/wall application.

B. Concrete Floors: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring. Floor slabs shall be prepared as follows:

1. Mechanically remove all finishes, mastics, adhesives and other compounds down to sound substrate. Demolition shall be in accordance with manufacturer's recommendations and written procedures. (Note: If during the demolition a setting bed

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- is found beneath the existing flooring materials, manufacturer will provide written recommendation whether to remove it or leave it in place. If removal is required, installer will provide a change order to replace the setting bed with manufacturer's recommended material to provide proper sloping for drainage and to insure proper adhesion of the specified coating system.)
2. Profile sound surfaces for proper adhesion. For thin-film coatings and floors under 1,000 sf or with limited access: Diamond grind to expose concrete matrix and profile concrete floor surfaces to a classification of ICRI CSP2.
 3. For all other floor systems: Shot blast all concrete floor surfaces to a classification of ICRI CSP5.
 4. Visually inspect shot blasted or grinded surfaces to make sure that profiled surfaces are free of contaminants. Areas that are stained or visually contaminated shall be treated with a 15% by volume solution of aqueous tri-sodium phosphate (TSP) or other de-greasing agent as recommended by the coatings manufacturer. Rinse and dry all floor surfaces scheduled to receive high performance floor system finish prior to commencement of resinous flooring application.
 5. Remove and legally dispose of all debris and contaminants produced by the demolition and surface preparation process. Steel media resulting from the shot blasted floor slab surface shall be removed from cracks, slab edges, construction joints, and corners by magnets, magnetic broom, air blast, vacuum, or stiff bristle broom.
- C. Concrete Walls and Ceilings, Existing Tile or Glazed Block: Abrasive Blast or mechanically abrade surfaces to achieve a ICRI CSP2 or ICRI CSP3 anchor profile for coating. Pre-patch as required. Note: A Prime Coat technician may advise for complete removal of any existing tile. If this is the company's recommendation, the tile will be fully removed to sound substrate. This includes full removal of existing mastics or other surface contaminants.
- D. Cement Board:
1. Patch damaged areas using manufacturer's recommended 100% solids epoxy patching materials.
 2. Joints and edges to be patched and taped with manufacturer's recommended 100% solids epoxy patching compound and reinforcing meshed tape.
 3. All surfaces shall be clean, dry and free of contaminants prior to installing coating system.

3.3 INSTALLATION

- A. General: Apply components of resinous coating system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface at the specified thickness.
1. Coordinate application of components to provide optimum adhesion of resinous floor/wall system to substrate and intercoat adhesion.
 2. At substrate control, isolation, and expansion joints, provide joint as necessary in resinous flooring in compliance with manufacturer's directions and engineering details for each joint type.
 - a. Apply backer rod and elastomeric joint filler into isolation or expansion joints in compliance with manufacturer's directions.

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B. Installation of SC-2 Prime Cast 2410

1. Cove Base as required: Trowel apply cove base by using a mixture of PC 310 resin and manufacturer's recommended aggregate to form required cove base as recommended cove base. Cove base type: 2 inch Cant Cove. Pull cove base material tight against wall and floor interface to form a uniform reinforced seal.
2. Slurry apply PC 352 SL Cretecoat mixed liquids and cement filler onto area to be coated and using a gauged rake, pull material back and forth in an "S" pattern to manipulate the material into an even layer at required thickness.
3. While material is wet and resin is open, broadcast to rejection PCA 331 standard broadcasting aggregate and allow to cure.
4. Vacuum up any excess aggregate and apply one full coat of PC 421 pigmented with PC 499 at 16-20 mils.

C. Installation of SC-5 Seamless Shower System 5130

1. Flexible Membrane: (required on all concrete slabs that are above grade or above occupied spaces) Install one full coat of PC 620 at 30 mils WFT on required and prepared concrete slabs and run it up the wall the distance of cove base.
2. Cove Base: Prime the interface of wall and floor areas where cove base will be installed with PC 100 at 4-6 mils. (Note: areas receiving the above membrane will not need to be primed.) Allow to cure. Trowel apply cove base and threshold [if applicable] by using a mixture of 100% solids epoxy PC 310 and aggregates PCA 322 to make mortar system, and allow to set.
3. Floor Broadcast Coat: Apply one full coat of PC 310K at 20 mils, or 80 square feet per mixed gallon. While resin is open, broadcast PCA 322 aggregate into base coat to rejection and allow to dry. Sweep off/vacuum up all excess aggregate.
4. Primer/Filler Coat for walls and ceilings only: Mix primer/thixotropic block fill PC 630 components with a Jiffy Mixer for a minimum of 2 minutes, then apply by roller or spray to floors, walls and ceilings. Note: Wall areas that are porous, i.e. concrete masonry units require a minimum of 12-20 mils while less porous substrates such as ceilings and floors require a minimum thickness of 6-8 mils.
5. Build Coat all surfaces: Mix PC 200 fiberglass/Kevlar®-reinforced body coat with a Jiffy Mixer for a minimum of 2 minutes and spray apply to all surfaces with a 45:1 air-powered airless spray rig with gravity-fed hopper at and allow curing. Minimum thickness of 45 mils required on walls and floors. Minimum of 20-25 mils on ceilings.
6. Final Finish/Glaze Coat: After build coat is fully cured, abrade all surfaces to remove any exposed fiberglass and other imperfections. Mix PC 400 with PC 499 additive and apply to all surfaces, walls, ceilings and floors at a minimum of 8 mils to wall and ceiling surfaces and 10-12 mils on floor surfaces. Broadcast and back-roll PCA 337 slip resistant additive into final floor finish encapsulating the slip resistant additive to achieve ADA requirements.
7. The finished floor must meet ADA specifications for this project. Installer shall provide a Sullmair FSC 2000-1346 Floor tester to validate ADA requirements. Note: Achieving the required ADA coefficient of friction may require additional topcoat material or slip resistant additives.

D. Manufacturer's Field Service:

1. Manufacturer will send qualified technical representative to the Project site for the

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following purposes:

- a. Coordinate schedule, environmental requirements, and pre-installation work with other trades.
- b. Advise Installer's personnel of procedures and precautions for use of flooring materials.
- c. Attend moisture testing and all other testing procedures with the Architect/Engineer, the Owner's Representative, and the Installer.
- d. Observe field mockups with the Engineer/Architect, the Owner's Representative, and the Installer.
- e. Ascertain that each component of the resinous flooring system is being installed in accordance with manufacturer's directions.
- f. Maintain a log of environmental conditions, work procedures, testing procedures, and protection measures to be included in job site file submittal.
- g. Manufacturer's representative shall be on site throughout the entire product installation including all of the above, all surface preparation and product installation.

3.4 CURING

- A. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during curing processes.
 1. Temperatures shall be maintained at 70°F – 80°F if at all possible.
 2. Water leaks must be prevented as they will compromise epoxy components ability to set properly – water drips may compromise or stain finishes.
 3. Steam or any airborne contamination will adversely affect curing.

3.5 CLEANING

- A. Work area shall be left clean with all trash, equipment, and leftovers removed.
- B. Floor and walls may be cleaned prior to final inspection, providing complete curing has taken place. [Refer to Product Data Sheets for curing information for each product]. Generally, non-chlorinated detergents should be used for the first month after curing is complete.
- C. For optimum coating performance and cleanability, manufacturer recommends the use of liquid soaps to prevent caking on epoxy surfaces caused by bar soaps.

3.6 PROTECTION

- A. Protection from damage and wear during the construction process is recommended. Comply with manufacturer's recommendations for protective materials and their method of application. Remove temporary protection prior to final inspection. Protection from welding, impact from heavy tools and other abuse is anticipated, the contractor doing the work shall take extra care in protecting the floor with impact resistance and if necessary, flame resistant coverings. Removal of any temporary or protective material is not the responsibility of the Installer.

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END OF SECTION 099656

SECTION 101419 - DIMENSIONAL LETTER 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. Cast dimensional characters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For 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, 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- 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.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACE Sign Systems, Inc.
 - b. ASI Sign Systems, Inc.
 - c. Gemini Incorporated.
 - 2. Character Material: Cast aluminum.
 - 3. Character Height: As indicated on Drawings.
 - 4. Thickness: Manufacturer's standard for size of character.
 - 5. Finishes:
 - a. Integral Aluminum Finish: Clear anodized.
 - 6. Mounting: Projecting studs.
 - 7. Typeface: Arial.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

2.4 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:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

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3. Sign Mounting Fasteners:

- a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. 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. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters 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 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Panel signs.
 - 2. Room occupancy signs.

1.2 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.3 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 others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 - 4. Message Content Layout Drawings: Furnish scaled face layout drawings for each sign type and unique copy layouts of each sign type for approval. Face layouts drawings shall show type style, type size, type alignment and spacing, spelling, punctuation, word placement on sign face referenced to outline of sign face, line spacing, logos and other composition requirements.
- 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: Full-size Sample.
 - 2. Room-Identification Signs: Full-size Sample.
 - 3. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.

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4. Exposed Accessories: Full-size Sample of each accessory type.

- E. Field Mock-Ups: Provide full size mock-ups and/or sample installations of signage elements as required in the Design Drawings. These submittals are required for Architect and for Owner approval of the size, appearance, and design compliance prior to fabrication. Locate mock-ups on Site in locations as directed by Architect. Retain mock-ups during construction as a standard for judging completed sign work. Acceptable signs may be included as part of the Work.
- F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Braille Certification: Submit certified letter as to the accuracy of all Braille messages in this graphics program. Certification shall be from a Library of Congress Braille translator, the Lighthouse for the Blind, or other source acceptable to the Owner.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.
 - 1. Maintenance Manuals and Instructions: Include written instructions for removal of signs attached to wall surfaces including recommended methods for removal of residual adhesives. Prior to final acceptance date, submit two bound operating and maintenance manuals with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing, diagnostic and repair information available to manufacturer's and Installer's maintenance personnel, emergency instructions, as-built wiring diagrams and similar information organized behind labeled tabs.

1.6 QUALITY ASSURANCE

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

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and "2013 California Building Code" for signs.

2.2 SIGNS

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

1. ACE Sign Systems, Inc.
2. APCO Graphics, Inc.
3. ASI Sign Systems, Inc.
4. Best Sign Systems, Inc.
5. InPro Corporation (IPC).
6. Or equal.

- B. Panel Sign **Type A**: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign: Aluminum sheet with finish specified as follows:
 - a. Thickness: Manufacturer's standard for size of sign.
 - b. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.
 - c. Size: 10 inches by 12 inches.
 - d. Copy: KNOX BOX

- C. Panel Sign **Types B and C**: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Acrylic face sheet with raised painted graphics laminated over frosted polycarbonate backing sheet to produce composite sheet over metal retainer frame.
 - a. Composite-Sheet Thickness: **0.125 inch (3.18 mm)**.
 - b. Size:
 - 1) Type B: 12 inches by 18 inches.
 - 2) Type C: 12 inches by 24 inches.
 - c. Copy:
 - 1) Type B: LIGHTWEIGHT ROOF STRUCTURE

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- 2) Type C: NO CAMERAS OR VIDEO TAPING BEYOND THIS POINT – BY ORDER OF SHERIFF
 - d. Surface-Applied Graphics: Applied vinyl film.
 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Square.
 - c. Acrylic: Diamond polish.
 - d. Polycarbonate: Match main surface.
 3. Frame: Unframed.
 4. Mounting: Aluminum bracket with concealed anchors.
 5. Surface Finish and Applied Graphics:
 - a. Integral Acrylic Sheet Color: As selected by Architect from full range of industry colors.
 - b. Painted Finish and Graphics: Manufacturer's standard, factory-applied exterior-grade sign paint, in color as selected by Architect from manufacturer's full range.
 6. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as indicated. Finish raised characters to contrast with background color, and finish Braille to match background color.
 7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
- D. Room Occupancy Signs **Type D**: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to frost polycarbonate sheet over polycarbonate backing sheet to produce composite sheet with acrylic changeable message insert.
 - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign 0.125 inch (3.18 mm).
 - b. Size: 10 inches by 12 inches.
 - c. Copy: As provided by Architect.
 - d. Color(s): Match Architect's sample.
 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Square.
 - c. Frosted Polycarbonate: Match main surface.
 - d. Frosted Polycarbonate Backer: Diamond polish.
 - e. Acrylic: Diamond polish.

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3. Frame: Unframed.
4. Mounting: Surface mounted to wall with concealed anchors.
5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 FIELD-APPLIED, STENCILED PAINT SIGNS

A. Field-Applied, Stenciled Paint Sign **Types E, F and G**: Acrylic polyurethane paint characters.

1. Size: As indicated.
2. Substrate: As indicated.
3. Text and Font: As indicated.
4. Type E: Numbers at cells and pods.
5. Type F: Rated wall identification.
6. Type G: Fire extinguisher identification.

2.4 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: **ASTM B 209 (ASTM B 209M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Steel Materials:

1. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed.
2. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, **42,000-psi (290-MPa)** minimum yield strength.
3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

D. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

1. Cast Acrylic Sheet: Provide clear cast (not extruded or continuous cast) methacrylate plastic sheet with a minimum flexural strength of 16,000 psi, ASTM D 790, minimum allowable continuous service temperature of 180-degrees F (82-degrees C); in sizes and thicknesses indicated:
 - a. "Plexiglas" by Rohm and Haas.
 - b. Acrylite GP by Cyro Industries.
 - c. "Lucite L" by General Electric.
 - d. Or equal.

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- E. Photopolymer: Furnish photo-polymer with a durometer reading of 90.
- F. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- G. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.
- H. Polyurethane Enamel: Provide polyurethane enamel consisting of ultra-violet inhibitors which are lightfast, weather, abrasion and wear resistant. Provide one of the following:
 - 1. Matthews Paint.
 - 2. Chemglaze, Hughson Chemical Division, Lord Corp.
 - 3. Imron, DuPont de Nemours & Co.
 - 4. Or equal.
- I. 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.

2.5 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use security fasteners unless otherwise indicated.
 - 3. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

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2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.
 2. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
 3. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
 4. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
- C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.
- E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- F. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

2.7 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.

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- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.8 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.9 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.
 - 1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

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 signage 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 anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. 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. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard Insert requirement.
- C. Mounting Methods:
 - 1. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 - 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. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

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 SUMMARY

A. Section Includes:

1. Corner guards.
2. End-wall guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, full height units.
 - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guard in a horizontal position.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.
- B. Basis-of-Design Product: Project design is based on Construction Specialties, Inc., unless otherwise indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. InPro Corporation (IPC).
 - 2. Nystrom, Inc.
 - 3. Tepromark International, Inc.
 - 4. Or equal.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS CG-01

- A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90-degree turn to match wall condition.
 1. Basis-of-Design: Construction Specialties Acrovyn Model SSM-20AN.
 2. Cover: Extruded rigid plastic, minimum **0.078-inch (2.0-mm)** wall thickness; as follows:
 - a. Profile: Nominal **2-inch- (50-mm-)** long leg and **1/4-inch (6-mm)** corner radius.
 - b. Height: Full height.
 - c. Texture: Pebblete.
 - d. Color: As selected by Architect from manufacturer's full range.
 3. Continuous Retainer: Minimum **0.060-inch- (1.5-mm-)** thick, one-piece, extruded aluminum.
 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS CG-02

- A. Flush-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover that is flush with adjacent wall surface and that covers entire end of wall, installed over continuous retainer; including mounting hardware.
 1. Basis-of-Design: Construction Specialties Acrovyn Model FSC-25N.
 2. Cover: Extruded rigid plastic, minimum **0.078-inch (2.0-mm)** wall thickness; as follows:
 - a. Profile: Nominal **2-inch- (50-mm-)** long leg and **1/4-inch (6-mm)** corner radius.
 - b. Height: Full height.
 - c. Texture: Pebblete.
 - d. Color: As selected by Architect from manufacturer's full range.
 3. Retainer: Minimum **0.060-inch- (1.5-mm-)** thick, one-piece, extruded aluminum.

2.5 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. 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.

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2.6 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

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- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Adjust caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories.

B. Related Requirements:

1. Section 111963 "Detention Furnishings and Equipment" for accessories designed for installation in detention facilities.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Basis-of-Design Product: Project design is based on Bobrick Washroom Equipment, Inc., unless otherwise indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bradley Corporation.
- C. Toilet Tissue Dispenser: **TTD**
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-2888 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 20030.
 - b. Bradley Corporation; 5402.
 - 2. Description: Double-roll dispenser.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Noncontrol delivery with theft-resistant spindle.
 - 5. Capacity: Designed for 4-1/2- or 5-inch (114- or 127-mm) diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 7. Lockset: Tumbler type.

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D. Paper Towel (Folded) Dispenser: **PTD-S**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-262 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 0210.
 - b. Bradley Corporation; 250-15.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides or front.

E. Combination Towel (Folded) Dispenser/Waste Receptacle: **PTD-R**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-3949 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 04697-9.
 - b. Bradley Corporation; 237-11.
 - c. Or equal.
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Surface mounted.
4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: **12 gal. (45.4 L)**
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Liner: Stainless steel, No. 4 finish (satin).
8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

F. Liquid-Soap Dispenser: **SDR-W**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-2111 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 0347.
 - b. Bradley Corporation; 6563.
2. Description: Designed for dispensing antibacterial soap in liquid form.
3. Mounting: Surface mounted.
4. Capacity: 40-fl **oz. (1.2-L)**.
5. Refill Indicator: Window type.

G. Grab Bar: **GBL**

1. Basis-of-Design Products: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-6806 Series or a comparable product by one of the following:
 - a. American Specialties, Inc.; 3200 Series.
 - b. Bradley Corporation; 8120 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, **0.05 inch (1.3 mm)** thick.
 - a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: **1-1/2 inches (38 mm)**.
5. Configuration and Length: As indicated on Drawings.

H. Sanitary-Napkin Disposal Unit: **SND**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-254 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 0473-1A.
 - b. Bradley Corporation; 4722-15 or 4721-15.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

I. Mirror Unit: **M-A**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-290 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 0620.
 - b. Bradley Corporation; 781.
2. Frame: Stainless-steel angle, **0.05 inch (1.3 mm)** thick.
 - a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

J. Baby Changing Station: **BCS**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; Koala Kare KB110-SSWM or a comparable product by one of the following:
 - a. American Specialties, Inc.; 9013-9.
 - b. Bradley Corporation; 962-11.
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 (113-kg)** static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than **4 inches (100 mm)** from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, No. 4 finish (satin), exterior shell with rounded corners; HDPE interior in manufacturer's standard color.
6. Liner Dispenser: Built in.

K. Specimen Pass-Through Cabinet: **P-S**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-505 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 8154.
 - b. Bradley Corporation; 9813.
2. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at same time, and removable stainless-steel tray.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain and Rod: **SC**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-204 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 1200.
 - b. Bradley Corporation; 9533 and 9538.

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2. Shower Rod:

- a. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-) thick stainless steel.
- b. Mounting Flanges: Stainless-steel flanges designed for concealed fasteners.
- c. Finish: No. 4 (satin).

3. Shower Curtain:

- a. Size: Minimum 12 inches (305 mm) wider than opening by 72 inches (1828 mm) high.
- b. Material: Vinyl, minimum 0.006 inch (0.15 mm) thick, opaque, matte.
- c. Color: White.
- d. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
- e. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

C. Folding Shower Seat – Fixed: **SS**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-5181 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 8206.
 - b. Bradley Corporation; 9569.
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

D. Soap Dish: **SD**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc.; B-4380 or a comparable product by one of the following:
 - a. American Specialties, Inc.; 0401.
 - b. Bradley Corporation; 9403.
2. Description: One piece seamless construction.
3. Mounting: Recessed.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

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B. Utility Shelf: **S-U**

1. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.
2. Size: 24 inches (406 mm) long by 6 inches (152 mm) deep.
3. Material and Finish: Not less than nominal 0.05-inch (1.3-mm) thick stainless steel, No. 4 finish (satin).
4. Products:
 - a. Bobrick Washroom Accessories, Inc., B-296.
 - b. Bradley Corporation, Model 756.
 - c. American Specialties, Inc., Model 0692.

C. Mop and Broom Holder: **MBH**

1. Description: Unit with shelf, hooks, and mop and broom holders.
2. Length: 34 inches (863 mm).
3. Hooks: Four.
4. Mop/Broom Holders: 3, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch (1.3-mm) thick stainless steel.
6. Products:
 - a. Bobrick Washroom Equipment, Inc., B-239.
 - b. Bradley Corporation, Model 9933.
 - c. American Specialties, Inc., Model 1308

2.5 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- C. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- F. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

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2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.2 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. Samples: For each type of exposed finish required.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 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.

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

- a. JL Industries, Inc.; a division of the Activar Construction Products Group; Ambassador Series, Model 1016 with S21 solid door.
- b. Larsens Manufacturing Company; Architectural Series.
- c. Modern Metal Products, Division of Technico Inc.; Series 100.
- d. Potter Roemer LLC; Alta Series.

- B. Cabinet Construction: Nonrated, 1-hour fire rated, or 2-hour fire rated as required by wall construction.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from ~~0.043-inch-~~ (1.09-mm-) thick cold-rolled steel sheet lined with minimum ~~5/8-inch-~~ (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

- C. Cabinet Trim Material: Cold-rolled steel sheet.

- D. Door Material: Cold-rolled steel sheet.

- E. Door Style: Solid opaque panel with frame.

- F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide concealed hinge permitting door to open 180 degrees.

- G. 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.

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2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Engraved.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

H. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.

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 (13 mm)** thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

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- 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 cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

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.

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- 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 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; a division of the Activar Construction Products Group; Cosmic 10E or a comparable product by one of the following:
 - a. Larsens Manufacturing Company; MP-10.
 - b. Modern Metal Products, Division of Technico Inc.
 - c. Potter Roemer LLC; 3310.
 - 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 (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- 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 (1372 mm) 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 111900 – GENERAL PROVISIONS FOR DETENTION WORK

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 responsibilities for a single-source Detention Equipment Contractor and special procedures for Detention Work.
- B. Detention Work required by, but not specified in, this Section work includes the following:
 - 1. Division 11 Section “Detention Hollow Metal Doors and Frames”
 - 2. Division 11 Section “Detention Hardware”
 - 3. Division 11 Section “Detention Sliding Door Locks Devices”
 - 4. Division 11 Section “Detention Glass and Glazing”
 - 5. Division 11 Section “Detention Furnishings and Equipment”
 - 6. Division 11 Section “Detention Toilet Accessories”
 - 7. Division 11 Section “Detention Hollow Metal Wall Panels”
 - 8. Division 11 Section “Detention Enclosures”

1.3 DESCRIPTION OF WORK

- A. General Contractor:
 - 1. The General Contractor shall employ a single pre-approved Detention Equipment Contractor having met all the requirements listed in this Section. The General Contractor shall list his Detention Equipment Contractor on the bid form. Contracting by the General Contractor for separate portions of work under Sections 111900 through 111963 is prohibited.
- B. Detention Equipment Contractor (DEC):
 - 1. The Detention Equipment Contractor shall be responsible for submitting an aggregate bid to the General Contractor for all Division 11 Detention and Security work described herein and elsewhere in the Contract Documents.
 - 2. The Detention Equipment Contractor shall be responsible for the interfacing and integration of products and systems with the General Contractor and the Security Electronics Contractor (SEC) to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.
 - 3. The Detention Equipment Contractor shall provide a full time Superintendent to

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supervise the work in this section. The Superintendent shall be at the site when the Detention Equipment Contractor's work is being performed at the site.

1.4 QUALITY ASSURANCE

- A. The Detention Equipment Contractor (DEC) shall furnish detention equipment as described in these sections, and shall coordinate this equipment with his manufacturers, fabricators, installers, and with work by others. Questions on the detention equipment must be directed to the Detention Equipment Contractor before being directed to the General Contractor, Architect/Engineer or Owner.
- B. Acceptable Pre-qualified Detention Equipment Contractors:
 - 1. CML Security; Broomfield, CO 80023; 720/466-3650
 - 2. Cornerstone Detention Products, Inc.; Tanner, AL 35671; 877/374-7311
 - 3. Jails Correctional Products; Minster, OH 45865; 419628-4428
 - 4. Montgomery Technology Systems, LLC; San Antonio, TX 78216; 334/382-7441
 - 5. Noah Detention Construction; Niceville, FL 32578; 850/279-3257
 - 6. Pauly Jail Building Co., Inc.; Noblesville, IN 46062; 317/580-0833
 - 7. SecurTec Inc.; Denham Springs, LA 70726; 225/380-5536
 - 8. Southern Folger Detention Equipment Company; San Antonio, TX 78223; 210/533-1231
 - 9. Stronghold Industries; Racine, WI 53406; 262/886-1077
 - 10. Sweeper Metal Fabricators Corp.; Drumright, OK 74030; 918/352-2133
 - 11. U.S. Security Systems, Inc.; Dadeville, AL 36853; 334/273-8778
 - 12. Valley Security Company; Elgin, IL 60177; 847/888-9972
- C. Other Detention Equipment Contractor who intends to submit a bid on this section of the Specifications shall submit the following data to the Architect in writing twenty (20) days prior to bid date and shall be approved by addendum ten (10) days prior to bid date. Verbal approval will not satisfy this requirement. Grounds for disqualification shall exist if it is proven that the information submitted is inaccurate or, in the opinion of the Architect, does not satisfy the requirements.
 - 1. Contractor Qualification Statement AIA-305A.
 - 2. List of projects under construction. The list shall include the following information for each project:
 - a. Name and location of installation
 - b. General Project Description
 - c. Name of Owner's representative and phone number
 - d. Name of Architect/Engineer and phone number
 - e. Name of General Contractor and phone number
 - f. Contract amount
 - g. Percent Complete
 - h. Scheduled completion date
 - 3. Evidence that this firm or principal members have a minimum of ten (10) years' experience in successfully completing projects of equal scope and magnitude with products as specified. Submit a list of ten (10) projects of similar scope that have been

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completed and operational for a minimum of three (3) years. The list shall include the following information for each project:

- a. Name and location of installation
 - b. General Project Description
 - c. Date of occupancy by Owner
 - d. Name of Owner's representative and phone number
 - e. Name of Architect/Engineer and phone number
 - f. Name of General Contractor and phone number
 - g. Contract amount
 - h. Percentage of the cost of the work performed with your own forces.
4. List of key personnel and qualifications.
 5. List of all projects in the past five (5) years in which this firm has been involved in litigation with a City, County, State or Federal government agency. Include the current status of each legal action, and the other parties to the litigation.
 6. Letter from an approved and A-15 rated bonding company stating that the Detention Equipment Contractor can be bonded for this complete project if awarded the Contract.
 7. Financial Statement for previous fiscal year.
 8. List of manufacturers of all equipment intended to be bid as part of your work.
 9. Letters from manufacturers of detention hollow metal door and frames, detention hardware and detention sliding door locking devices stating that your firm will be able to purchase all materials required for this project.
 10. Letters from specified detention hardware and detention sliding door locking devices manufacturers that your firm is a qualified installer of their products.
- D. Materials required for installation by the Detention Equipment Contractor may be provided by any of the detention equipment manufacturers included in the Project Manual. The Detention Equipment Contractor shall receive the materials and assume complete responsibility for the detailing, coordination, erecting, installation and performance and warranty of such work.
- E. The Detention Equipment Contractor shall be required to provide a labor and materials payment bond in the amount of 100% of the contract sum.

1.5 COORDINATION

- A. Coordinate detention work to ensure efficient and orderly installation of each part of detention work. Coordinate detention work that depends on each other for proper installation, connection, and operation.
1. Develop special procedures required for coordination of detention work.
 2. Coordinate installation of different detention components to ensure maximum accessibility for required maintenance, service, and repair.
 3. Coordinate provisions to accommodate detention work scheduled for later installation.
- B. Coordinate selection of detention products for compatibility.
- C. Assemble and coordinate Shop Drawings for detention work provided by separate entities responsible for detention work. Submit detention work submittals simultaneously as a group

along with applicable Coordination Drawings.

- D. Coordinate installation of anchorages and embedment's for detention work. Obtain and distribute, to parties involved, 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. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing detention work to comply with indicated requirements.
- E. Coordinate protection of detention work.
- F. Coordinate preparation of Project Record Documents for detention work and integrate information from entities responsible for detention work to form one combined record.
- G. Coordinate preparation of operation and maintenance manuals for detention work and integrate information from entities responsible for detention work to form one combined record.

1.6 SHAKEDOWN PERIOD

- A. The Detention Equipment Contractor shall coordinate with the General Contractor to establish a shakedown period for the detention work. The shakedown period shall be a minimum of thirty days and shall be completed after Substantial Completion.
- B. Prior to initiation of the shakedown period, all work related to and supporting the detention material shall be completed.
- C. The Detention Equipment Contractor shall maintain a log of all anomalies, malfunctions, and repairs encountered during the shakedown period. The log shall be submitted to the Architect for assessment at the conclusion of the shakedown period.
- D. Training of the Owner's staff shall occur after substantial completion.

1.7 WARRANTY

- A. The Detention Equipment Contractor shall warrant materials furnished under this Section to be free from defects in material and workmanship. The Detention Equipment Contractor shall provide all labor and materials to repair or replace defective detention equipment work or components.
- B. The Detention Equipment Contractor shall maintain the quantities of spare parts provided to the Owner in the original inventory during the warranty period. Components used for repair shall be replaced immediately and Owner shall not be charged for shipping or other costs unless failure is due to abuse or negligence.
- C. The Owner and/or Owner's Representative shall notify the Detention Equipment Contractor on a twenty-four (24) hour phone number (supplied by the Detention Equipment Contractor),

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outlining defects in the detention equipment. The Detention Equipment Contractor shall respond to this call within two hours with a return call by a service technician.

- D. The warranty shall exclude vandalism, misuse, acts of nature or abuse.
- E. The warranty shall provide for a maximum response time (service technician on the site) of twenty-four (24) hours on the first occurrence and twelve (12) hours on the second occurrence. The Detention Equipment Contractor shall also guarantee shipment of any part request within twenty-four (24) hours during the warranty period.
- F. Record maintenance and service calls by signing the Owner's project logbook maintained on the premises.

PART 2 - PRODUCTS (Not Used)

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 detention work.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention work connections before detention work installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of detention work.
- B. Inspect built-in and cast-in anchor installations before installing detention work to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Where inspections indicate that anchors do not comply with specified requirements, re-inspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Verify locations of detention work with those indicated on Coordination Drawings.

3.2 FIELD QUALITY CONTROL

- A. Observe field welding of detention work and anchorages.
- B. Verify that detention work is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements in Division 26 Sections.

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- D. Observe startup service of detention work.
- E. Observe installation and startup checks of detention work according to manufacturer's written instructions.
- F. Inspect installed detention work to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
 - 1. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
 - 2. Prepare field quality-control certification that states installed detention work and its installation complies with requirements in the Contract Documents.
- G. Testing: After installing detention work and after electrical circuitry has been energized, test detention work for compliance with requirements.
 - 1. When testing reveals detention work not in compliance with requirements, perform additional random testing to determine extent of noncompliance.
 - 2. Where test results indicate that detention work does not comply with specified requirements, retest after repairs or replacements are made.
 - 3. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work.

END OF SECTION 111900

SECTION 111913 - DETENTION HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Detention swinging hollow metal doors.
 - 2. Detention sliding hollow metal doors.
 - 3. Detention hollow metal frames.
 - 4. Detention hollow metal sidelight frames.
 - 5. Detention hollow metal borrowed-light frames.

- B. Related Requirements:

- 1. Division 04 Section "Unit Masonry Assemblies"
 - 2. Division 05 Section "Metal Fabrications"
 - 3. Division 05 Section "Tamper Proof Metal Fasteners"
 - 4. Division 07 Section "Security Joint Sealants"
 - 5. Division 09 Section "Painting"
 - 6. Division 11 Section "General Provisions for Detention Work"
 - 7. Division 11 Section "Detention Hardware"
 - 8. Division 11 Section "Detention Sliding Door Locks Devices"
 - 9. Division 11 Section "Detention Glass and Glazing"
 - 10. Division 13 Section "Prefabricated Precast Concrete Cell Modules"
 - 11. Division 26 for Electrical
 - 12. Division 27 for Communications
 - 13. Division 28 for Electronic Safety and Security

1.3 PERFORMANCE REQUIREMENTS

- A. Detention doors and frames for this Contract shall be constructed as specified and to meet the following tests. An independent testing laboratory shall perform the tests described below, with data attesting to construction of the door and frame. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.
 - 1. Doors tested in accordance with Standard UL-752, "Bullet Penetration".
 - 2. Doors tested in accordance with ASTM F 1450, "Door Assembly Impact Test".

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3. Doors tested in accordance with ASTM F 1450, “Door Static Load Test”.
4. Doors tested in accordance with ASTM F 1450, “Door Rack Test”.
5. Doors tested in accordance with Methods E152, Standard UL-10 (B), or Methods NFPA 252, “Door Assembly Fire Test”.
6. Doors tested in accordance with ASTM F 1450, “Door Edge Crush Test”.
7. Doors tested in accordance with NAAMM HMMA 863-98, “Removable Glazing Stop Test”.
8. Frames tested in accordance with ASTM F1592, “Standard Test Methods for Detention Hollow Metal Vision Systems”

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of detention door and frame specified.
- B. Shop Drawings: For detention doors and frames. Include conditions at openings, details of construction, dimensions of profiles, and details of joints and connections. Show anchorage and accessories. Identify each detention door and frame using same reference numbers for openings as those on Drawings.
- C. Coordination Drawings: Drawings of each opening, including detention door and frame, drawn to scale and coordinating detention door hardware. Show the following:
 1. Locations, dimensions, and profiles of detention door hardware reinforcements.
 2. Locations and installation details of detention door hardware.
 3. Elevations of each detention door design type showing dimensions, locations of detention door hardware, and preparations for power, signal, and electrified control systems.
 4. Details of each detention frame type.
- D. Samples:
 1. Door: 12 by 12 inches (305 by 305 mm) corner section with hinge mortise and reinforcement showing internal construction.
 2. Frame: 12 by 12 inches (305 by 305 mm) corner section showing welding of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied in both head and jamb section to show corner joint.
 3. Samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by the sample can be cause for rejection of the work.
- E. Certification by Manufacturer: That products supplied complies with performance requirements specified.
- F. Product Test Reports: Showing compliance with specified requirements.

- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Detention Equipment Contractor (DEC) Qualifications

1. General: Refer to Section 111900.

- B. Provide detention hollow metal work manufactured by a single firm specializing in the production of this type of work.

- C. Installation shall be under supervision of manufacturer-approved personnel.

- D. When a fire resistance classification is shown or scheduled for steel doors and frames, provide fire rated doors investigated and tested as a fire door assembly, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors.

- E. When a fire resistance classification is shown or scheduled for steel doors and/or frames containing components that have not been tested as an assembly, the manufacturer shall construct the door and frame components of the assembly in accord with the requirements of the testing laboratory for the desired fire resistance rating, and certify in writing to the Owner, Enforcing Authority, Contractor and the Architect that the door and frame components have been constructed in accord with the testing laboratory requirements in lieu of label.

F. Job Site Door Check:

1. When and as directed by the Architect, the Contractor shall destroy a randomly selected detention hollow metal door by sawing it in half or otherwise taken it apart as deemed necessary, for verification that construction is in accordance with these specifications.
2. When examination discloses door construction at variance with the details specified, the door manufacturer shall replace all doors shipped to the project, as of the date of inspection, with doors constructed in conformance with project specifications.
3. Under conditions of non-conformity, the door manufacturer shall pay for the destroyed door and related labor.
4. When examination proves that the door was constructed in conformance with specifications, the Owner will pay to replace the destroyed door and related labor for replacement.
5. Upon approval of the Architect dispose the destroyed door.

1.6 JOB CONDITIONS

- A. Hardware Coordination Conference: See Detention Hardware Section 111923.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle hollow metal work per manufacturer's requirements.

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer and installer agreeing to repair or replace materials furnished under this Section that fail in materials or workmanship within the specified warranty period. Submit the warranty to the Architect for approval.
- C. Warranty Period: One (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER OF DETENTION HOLLOW METAL DOORS AND FRAMES

- A. Source Limitations: Obtain detention doors and frames from single source from single manufacturer.
- B. Acceptable Manufacturers:
 - 1. Trussbilt Inc., St.Paul, MN
 - 2. American Steel Products, Swainsboro, GA
 - 3. Sweeper Metal Fabricators Corp.; Drumright, OK
 - 4. Willo Products; Decatur, AL

2.2 DETENTION HOLLOW METAL DOORS

- A. Materials:
 - 1. Galvanealed steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 653/A 653M, A60 zinc coating.
 - 2. Steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
 - 3. Interior and exterior doors: Face sheets shall be 0.093 inch (2.3 mm) minimum thickness galvanealed steel.
- B. Construction:
 - 1. Provide detention hollow metal doors of the types and sizes indicated on the drawings and schedules. Doors shall be constructed in accordance with the specifications and shall

- meet the performance requirements.
2. Doors shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the thickness of material used.
 3. Internal Core Construction: One of the following two (2) types may be used:
 - a. Door face sheets shall be vertically stiffened by formed steel sections which are continuous and upon assembly, shall span the full thickness of the interior space between door faces. These stiffeners shall be 0.042 inch (1.0 mm) minimum thickness, spaced so that the vertical interior webs shall be no more than 4 inches (102 mm) apart and securely attached to both face sheets by spot welds spaced a maximum of 3 inches (76 mm) on center vertically. After assembly of the door, stiffeners shall be welded together, on both sides, over their entire length with tack welds or spot welds spaced 16 inches (406 mm) on center maximum. Spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt-type material.
 - b. Continuous steel truss design core material, 0.015 inch (0.4 mm) minimum mild steel, having truncated triangular sections extending continuously from one panel face to the other, spot welded to each face sheet 2-3/4 inches (69.9 mm) on center horizontally and 3 inches (76.2 mm) on center vertically. Core material shall extend the full height and width of the panel. Internal hollow spaces shall be filled with fiberglass or mineral rock wool batt-type material.
 4. The vertical edges shall be reinforced by a continuous steel channel, not less than 0.123 inch (3.12 mm) minimum thickness extending the full length of the door. The top and bottom edges shall be closed with a continuous steel channel, not less than 0.123 inch (3.12 mm) minimum thickness, spot welded to both face sheets a maximum of 3 inches (76 mm) on center vertically. The 0.123 inch (3.12 mm) closing end channel shall be continuously welded to the vertical reinforcing channel at all four corners producing a fully welded perimeter reinforcing channel.
 5. The end channels shall be fitted with an additional flush closing channel of not less than 0.053 inch (1.3 mm) thickness. The flush closing channel shall be welded in place at the corners with continuous welds and 1 inch (25.4 mm) long welds, 12 inches (304 mm) on center maximum along the length, on both sides. Tops of exterior doors shall be made weather tight where specified.
 6. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door and finished smooth such that there are no visible seams.
 7. Doors shall be smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.
 8. Edge profiles shall be provided on both vertical edges of doors as follows:
 - a. Single acting doors - beveled 1/8 inch in 2 inches (3 mm in 51 mm) profile.
 - b. Sliding doors or equivalent - square profile.
 9. Hardware reinforcements and preparation:
 - a. Doors shall be mortised, reinforced, drilled and tapped at the factory for hardware, in accordance with the final approved hardware schedule and templates provided by the hardware supplier.
 - b. Minimum hardware reinforcement shall be as follows:

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- 1) Mortise hinges: Steel plate 0.187 inch (4.7 mm) thick by full height, secured by spot-welds 4 inches (102 mm).
 - 2) Mortise Locksets and Dead Bolts: 0.187 inch (4.7 mm) thick steel sheet, welded to inside of door on detention side (cell side) and 0.187 inch (4.7 mm) thick steel lock mounting plate, beveled at edges, applied to the surface of the door with security screws.
 - 3) Reinforcement for slide device hanger attachment: per device manufacturer's recommendations.
 - 4) Closers: 0.093 inch (2.3 mm) minimum thickness steel, secured with not less than 6 spot welds.
 - 5) Push Plates and Loop Pulls: 0.053 inch (1.3 mm) thick steel, secured with not less than 2 spot-welds.
 - 6) Automatic Door Bottoms: 0.093 inch (2.3 mm) minimum thickness steel.
10. Glass moldings and stops:
- a. Doors shall be provided with steel moldings to secure glazing by others in accordance with glass sizes and thicknesses shown on the drawings and approved submittal drawings.
 - b. Fixed glass molding shall not be less than 0.093 inch (2.3 mm) steel around perimeter, and shall be spot welded to both face sheets at 3 inches (76 mm) on center maximum.
 - c. Removable glass stops shall consist of 0.123 inch (3.12 mm) minimum thickness steel galvanealed angle. Angle stops shall be mitered or notched and tight fitting at the corner joints, and securely fastened to the frame using torx-head (star with center pin) security screws of the size, strength and spacing necessary to satisfy impact performance criteria.
 - d. Removable glass stops shall be on the side opposite the area of inmate confinement or where they are likely to be supervised.
11. Removable lock cover plate to be on the hinge side, unless door swings into a room and there is no other access to the room, then removable lock cover plate is to be on the stop side.
12. Coordinate electric hardware requirements to be integrally built into the door with the hardware requirements.
13. Provide dust box (welded to interior of door edge) at bolt receiver hole.
14. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
15. Food pass / cuff port openings:
- a. The food pass opening shall be a flush opening fabricated using interior channels, 0.093 inch (2.3 mm) minimum thickness steel, securely welded to the inside of both face sheets and dressed smooth. The four corner seams shall be continuously arc welded and dressed smooth. The finished opening shall be constructed such that it cannot be dismantled or otherwise affected by tampering.
 - b. Provide food pass shutters as detailed on the drawings. The food pass shutter shall be constructed from a hollow metal door panel. Welds shall be ground smooth. The food pass shutter and hinge shall be factory installed by plug welds.
 - c. The food pass shall be furnished with a full width Braun hinge, shutter bumpers, a

food pass lock, lock mount, and escutcheon.

2.3 DETENTION HOLLOW METAL FRAMES

A. Materials:

1. Galvanealed steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 653/A 653M, A60 zinc coating.
2. Steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
3. Interior and exterior openings: 0.093 inch (2.3 mm) minimum thickness galvanealed steel.

B. Construction:

1. Provide detention hollow metal frames of the types and sizes indicated on the drawings and schedules. Frames shall be constructed in accordance with the specifications and shall meet the performance requirements.
2. Frames shall be neat in appearance, square, and free of defects, warpage and buckles. Press steel members shall be straight and of uniform profile throughout their lengths.
3. Jamb, header, and sill profiles shall be as indicated on the drawings.
4. Fabricate frames with mitered corners continuously welded through head inside corner and miter ground smooth.
5. When shipping limitations or site access so dictate, or when advised by the contractor responsible for installation, frames for large openings shall be fabricated in sections designated for assembly in the field by others. Alignment plates or angles shall be installed at each joint. Such components shall be the same material and thickness as the frame. Field joints shall be made in accordance with approved submittal drawings, and shall be field welded by others.
6. Frames for multiple openings shall have mullion members which, after fabrication, are closed tubular shapes conforming to profiles shown on the drawings, and having no visible seams or joints. All joints between faces of abutted members shall be continuously welded and finished smooth. All joints between stops of abutted members shall be welded along the soffit and shall be left neat and uniform in appearance. The General Contractor shall provide for welding and finishing all field joints between faces of abutted members.
7. Hardware reinforcements and preparation:
 - a. Frames shall be mortised, reinforced, drilled and tapped at the factory for hardware, in accordance with the final approved hardware schedule and templates provided by the hardware supplier.
 - b. Minimum hardware reinforcement shall be as follows:
 - 1) Hinges and Pivots: Steel plate 0.187 inch (4.7 mm) thick by full width of jamb by full height of jamb.
 - 2) Provide an additional 0.187 inch (4.7 mm) thick angle back up drilled and tapped to accommodate security screws, welded to reinforcing and inside trim of frame.

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- 3) Strike Plate Clips: Steel plate 0.187 inch (4.7 mm) thick by 1-1/2 inches (38 mm) wide by 3 inches (76 mm) long.
 - 4) Closers: 0.093 inch (2.3 mm) minimum thickness steel, secured with not less than 6 spot welds.
 8. Floor anchors:
 - a. Floor anchors with two holes for fasteners shall be fastened inside jambs with at least four (4) spot welds per anchor.
 - b. Where so scheduled, adjustable floor anchors, providing not less than 2 inches (51 mm) height adjustment, shall be fastened inside jambs with at least four (4) spot welds per anchor.
 - c. Thickness of floor anchors shall be the same as frame.
 9. Jamb anchors:
 - a. Anchor spacing:
 - 1) The number of jamb anchors provided on each jamb shall be as follows:
 - a) For borrowed lite frames provide two (2) anchors plus one (1) for each 18 inches (457 mm) or fraction thereof over 36 inches (914 mm), spaced at 16 inches (406 mm) maximum between anchors.
 - b) For door frames provide two (2) anchors plus one (1) for each 18 inches (457 mm) or fraction thereof over 54 inches (1372 mm), spaced at 16 inches (406 mm) maximum between anchors (U.L. fire ratings may require additional anchors).
 - b. Masonry types:
 - 1) Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type made from the same thickness steel as the frame. Straps shall be no less than 2 inches (51 mm) by 10 inches (254 mm) in size, corrugated and/or perforated.
 - c. Expansion bolt type:
 - 1) Frames for installation in existing masonry or concrete walls shall be prepared for expansion bolt type anchors. The preparation shall consist of a countersunk hole for a 1/2 inch (12.7 mm) diameter bolt and a conduit spacer from the unexposed surface of the frame to the wall. The spacer shall be welded to the frame and spaced as described.
 - 2) After sufficient tightening of the bolt, the bolt head shall be welded by the installation contractor so as to provide a non-removable condition. The welded bolt head shall be ground, dressed and finished smooth.
 10. Grout guards shall be provided at hardware preparations, glazing stop screws and silencer preparations on frames to be set in masonry or concrete openings. Grout guards shall be sufficient to protect preparations from grout of a 4 inch maximum slump consistency

which is hand troweled in place.

- a. Glass stop screws shall be protected from grout by a steel threaded receptacle welded to the frame.
 - b. Door silencers (three (3) silencers per door minimum) preparations shall be protected by steel grout guards.
11. Frames shall be provided with two (2) temporary steel spreaders welded to the bottom of the jambs to serve as bracing during shipping and handling. The installation contractor shall be responsible for finishing and touch-up of marks caused by spreader removal.
 12. Removable lock cover plate to be on the hinge side, unless door swings into a room and there is no other access to the room, then removable lock cover plate is to be on the stop side.
 13. Provide grout openings for vertical hollow metal frames sections that are not accessible for grouting due to steel lintels or other obstructions. The General Contractor shall provide for filling grout openings and finishing.
 14. Provide separate conduit systems for door control, intercom, etc., within hollow metal frames.
 15. Removable glazing stops:
 - a. Removable glass stops shall consist of 0.123 inch (3.12 mm) minimum thickness steel galvanealed angle. Angle stops shall be mitered or notched and tight fitting at the corner joints, and securely fastened to the frame using torx-head (star with center pin) security screws of the size, strength and spacing necessary to satisfy impact performance criteria.
 - b. Removable glass stops shall be on the side opposite the area of inmate confinement or where they are likely to be supervised.
 - c. During shipment, non-security fasteners may be substituted to hold glass stops in place. The security fasteners shall then be included in the same shipment but packaged separately for protection until used to stop in the required glazing.
 - d. Provide an additional set of zinc security fasteners to be used after final painting of doors. Final fasteners shall not be painted.

2.4 CLEARANCES AND TOLERANCES

- A. Edge clearances for swinging doors shall not exceed the following:
 1. Between doors and frames at head and jambs: 1/8 inch (3.2 mm)
 2. At door sills where a threshold is used: 3/8 inch (9.5 mm)
 3. At door sills where no threshold is used: 3/4 inch (19 mm)
 4. Install fire-rated doors in accordance with NFPA Standard No. 80.
- B. Manufacturing tolerance shall be maintained within the following limits:
 1. Frames for single door or pair of doors: Width, measured between rabbets at the head: Nominal opening width +1/16 in., -1/32 in.. Height (total length of jamb rabbet): Nominal opening height $\pm$ 3/64 in.. Cross sectional profile dimensions:

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a.	Face	$\pm 1/32$ inch (0.8 mm)
b.	Stop	$\pm 1/32$ inch (0.8 mm)
c.	Rabbet	$\pm 1/32$ inch (0.8 mm)
d.	Depth	$\pm 1/32$ inch (0.8 mm)
e.	Throat	$\pm 1/16$ inch (1.6 mm)
f.	Flatness of large frames	1/8 in. in 10 ft. of length or width

2. Swinging and sliding door:

a.	Width	$\pm 3/64$ inch (1.1 mm)
b.	Height	$\pm 3/64$ inch (1.1 mm)
c.	Thickness	$\pm 1/16$ inch (1.6 mm)
d.	Hardware cutout dimensions	Template dimensions +0.015 in. - 0 in.
e.	Hardware location	$\pm 1/32$ inch (0.8 mm)
f.	Bow/ flatness	$\pm 1/8$ inch (3.1 mm)

2.5 FINISH

- A. After fabrication, doors and frames shall be thoroughly cleaned, degreased, bonderized and provided with one coat of primer.
- B. Shop Applied Primer: Manufacturer's standard rust inhibitive enamel. Verify compatibility with finish coats as specified in Section 099100, Painting. If compatibility is not ascertained during the bidding period, Contractor shall provide primer as specified in Section 099100, Painting.

2.6 ELECTRICAL REQUIREMENTS

- A. Detention hollow metal fabricator shall furnish and install junction boxes and conduit between junction boxes in door frames for electronic locks, door position switches, and intercom call stations; coordinate special hardware requirements with the Electrical Contractor and Detention Equipment Contractor.
- B. See the Detention Hardware Schedule, the Detention Hollow Metal Door Schedules, and Details.

2.7 DETENTION EQUIPMENT ACCESSORIES

- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
 - 1. Provide torx-head (star design with center pin) security fasteners for anchoring work in

- exposed detention areas. Comply with specification section 050553.
2. Finish shall match that specified of the item anchored.

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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Install Detention Hollow Metal Doors and Frames in accordance with shop drawings, manufacturer's written installation instructions, and as herein specified.
- C. Place detention hollow metal frames prior to construction of enclosing walls. Set frames accurately in position, plumbed and aligned (using metal shims), and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- D. Prior to installation, frames shall be checked for size, and swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumb. Permissible installation tolerances shall not exceed the following:
 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of face.
 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line

from head to floor.

- E. Install fire-rated frames in accordance with NFPA Standard No. 80.
- F. Grout fill solid detention hollow metal frame jambs, muntins, sill and head sections. Sill shall be packed solid with mortar before setting of frame. Provide grout openings in detention hollow metal frames where access to fill frames may be restricted due to steel lintels or other obstructions.
- G. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- H. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika and paint equipment to match surrounding materials.

3.3 ADJUSTMENT AND CLEANING

- A. Check and readjust Detention Hollow Metal Doors and Frames just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.
- B. Clean equipment thoroughly prior to Substantial Completion.

3.4 PROTECTION

- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111913

SECTION 111923 – DETENTION DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Detention door hardware items specified
 - 2. Detention electric locks.
 - 3. Detention mechanical locks.

- B. Related Requirements:

- 1. Division 05 Section “Tamper Proof Metal Fasteners”
 - 2. Division 11 Section “General Provisions for Detention Work”
 - 3. Division 11 Section “Detention Hollow Metal Doors and Frames”
 - 4. Division 11 Section “Detention Sliding Door Locks Devices”
 - 5. Division 13 Section “Prefabricated Precast Concrete Cell Modules”
 - 6. Division 26 for Electrical
 - 7. Division 27 for Communications
 - 8. Division 28 for Electronic Safety and Security

1.3 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 detention door hardware.

- B. Shop Drawings: For each type of detention door hardware. Include openings by door number and location, manufacturer's names, catalog numbers, keying information, materials, and finish. The Architect/Engineer's approval of schedule will not relieve Contractor or Supplier of responsibility for errors or omissions which it might contain.

- C. Certification by Manufacturer: That products supplied complies with performance requirements specified.

- D. Qualification Data: For Installer.

- E. Product Test Reports: Showing compliance with specified requirements.

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- F. Maintenance Data: For each type of detention door hardware to include in maintenance manuals.
- G. Sample Warranties: For special warranties.
- H. Detention Keying Schedule: Coordinate a Detention Keying Meeting with the Architect, User, and hardware supplier so as not to delay the manufacturer and delivery of the required detention locks. Submit keying system schedule after signed approval by User.

1.4 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications
 - 1. General: Refer to Section 111900.
- B. Installation and maintenance of the detention hardware shall be performed by manufacturer approved personnel. Submit certification of manufacturer training with shop drawings.

1.5 JOB CONDITIONS

- A. Detention Hardware Coordination Conference:
 - 1. A coordination conference will be held and coordinated by the General Contractor after submittals of schedules and shop drawings and during the submittal process period
 - 2. Participants: A qualified representative of each of the following parties will attend the conference:
 - a. Owner
 - b. Project Manager
 - c. Architect/Engineer
 - d. General Contractor
 - e. Detention Equipment Contractor
 - f. Electrical Contractor
 - g. Detention Hollow Metal Work Supplier
 - h. Detention Hollow Metal Work Installer
 - i. Detention Hardware Supplier
 - j. Detention Hardware Installer
 - 3. Bid Package Contractor shall take minutes of the hardware coordination conference.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention hardware per manufacturer's requirements.
- B. Delivery: Deliver items in manufacturer's original package. Each item individually packaged and carefully marked for intended opening and use. Each item complete with all necessary screws, bolts, keys, instructions, and where necessary, installation templates.

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- C. Storage: Store off floor in dry area of building out of way of other work in progress. Provide maximum protection against loss and damage.
- D. Handling: Handle items in a manner to prevent damage. Marred, defaced, damaged and defective items will be rejected.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of detention hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of detention hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.
 - 2. Warranty Period: Two (2) years from date of Substantial Completion.
 - 3. Warranty Period for Security Door Closers: Ten (10) years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Manual: Furnish a bound complete set of maintenance instructions as needed for Owner's continued adjustment, maintenance, repair, and removal and replacement of detention door hardware.
- B. Training: Provide on-site review of Operational and Maintenance manuals and spare parts with the Owner's designated personnel. Provide sixteen hours of training on repair and maintenance of the detention door hardware.
 - 1. Provide a professionally produced video tape on the repair and maintenance of the detention door hardware.
- C. Initial Maintenance Service: Beginning at Substantial Completion, provide at six (6) month intervals (coordinate exact time with the User) per year for the basic warranty period full maintenance by skilled employees of detention door hardware Installer. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper detention door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

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- A. Catalog numbers of the manufacturers listed have been used to establish the quality required. The only other manufacturers approved are listed. Other manufacturers seeking approval shall do so in writing per General Requirements and shall list exact catalog numbers and description of the items he proposes to furnish.

- B. DESIGNATIONS: Following abbreviations identify listed hardware manufacturers.

Airteq	Airteq Systems; Lake Oswego, OR
Brink	R.R. Brink Locking Systems, Inc.; Shorewood, IL
Glynn-Johnson	Glynn-Johnson Corp.; Indianapolis, IN
Hiawatha	Hiawatha Metalcraft, Inc.; Minneapolis, MN
Ives	H.B. Ives Div.; New Haven, CT
LCN	LCN Closers; Princeton, IL
Norton	Norton Closer Div.; Charlotte, NC
Pemko	Pemko Mfg. Co.; Emeryville, CA
Reese	Reese Enterprises; Rosemount, MN
Southern Folger	Southern Folger; San Antonio, TX
Zero	Zero Weatherstripping; Bronx, NY

2.2 DETENTION DOOR HARDWARE, GENERAL

- A. Provide detention hardware manufactured by a single firm specializing in the production of this type of work.
- B. Provide detention door hardware with features, functions, and internal equipment required to perform control and monitoring functions indicated in Division 28 - Electronic Safety and Security.
- C. Regulatory Requirements:
1. Fire-Rated Detention Door Assemblies: Provide detention door hardware for assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

2.3 DETENTION HINGES

- A. Heavy Duty, 4 1/2 FM:
1. Series/Manufacturer:
 - a. 604FMCS/Airteq
 - b. 4 1/2 SRS/Brink
 - c. 204FMSS/Southern Folger
 2. 4-1/2 inches by 4-1/2 inches (114.3 mm by 114.3 mm), 3/16 inch (4.7 mm) thick leaves.
 3. Cast stainless steel leaves with integral security studs, non-removable stainless steel pins, stainless steel ball bearings, three knuckle with "HT" hospital tips.
 4. Provide quantities as follows:

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- a. Doors less than 5 feet (1.524 meter) high provide 1 Pair.
- b. Doors over 5 feet to 7 feet 6 inches (1.524 meter to 2.286 meter) provide 1-1/2 Pair.
- c. Doors over 7 feet 6 inches to 10 feet (2.286 meter to 3.048 meter) provide 2 Pair.
- d. Doors over 3 feet (914.4 mm) wide provide 2 Pair.

2.4 DETENTION ELECTRIC LOCKS

A. Maximum Security - Electrical Operation:

1. Series/Manufacturer:
 - a. 9912SxRLB/Airteq
 - b. 5020S MCLH-M/Brink
 - c. 10120AE/Southern Folger
2. Frame mounted, 115VAC continuous duty solenoid operated.
3. Bolt is retracted electrically by icon at the control panel and remains retracted until door is opened.
4. Bolt is retracted manually by mogul key on outside and/or inside.
5. See Detention Hardware Schedule for keying.
6. Internal switches monitor status of bolt to show deadlocked and unlocked conditions.
7. Provide galvanized case at exterior installations.
8. Provide a key cylinder extension for locks keyed both sides or keyed stop side.

B. Maximum Security - Motor Operation:

1. Series/Manufacturer:
 - a. 9912M xRLB/Airteq
 - b. 5020M MCLH-M/Brink
 - c. 10120AM/Southern Folger
2. Frame mounted, 24 VDC, motor operated.
3. Bolt is retracted electrically by icon at the control panel and remains retracted until door is opened.
4. Bolt is retracted manually by mogul key on outside and/or inside.
5. See Detention Hardware Schedule for keying.
6. Internal switches monitor status of bolt to show deadlocked and unlocked conditions.
7. Provide a key cylinder extension for locks keyed both sides or keyed stop side.

2.5 DETENTION MECHANICAL LOCKS

A. Medium Security - Mechanical Operation:

1. Series/Manufacturer:
 - a. 5017M/Airteq

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- b. /Brink
 - c. 1017AM/Southern Folger
 - 2. Pin tumbler, mogul cylinder, key outside only.
 - 3. Automatic snaplatch
 - 4. Reverse bolt bevel at food pass locations. See details.
- B. Maximum Security - Mechanical Operation:
- 1. Series/Manufacturer:
 - a. 5070/Airteq
 - b. 7070/Brink
 - c. 1070A/Southern Folger
 - 2. Door mounted, paracentric key deadlocking latchbolt with three hardened steel pins.
 - 3. Bolt is retracted manually by paracentric key on outside and/or inside.
 - 4. See Detention Hardware Schedule for keying.
 - 5. Supply with hollow metal lock mounting, escutcheon and security screws.
 - 6. Provide strike as scheduled.
 - 7. Provide galvanized case and cylinder shields at exterior installations.

2.6 CLOSERS

- A. Manufacturers:
- 1. Norton
 - 2. Yale
 - 3. LCN
- B. Concealed Door Closure:
- 1. Overhead concealed door closers shall be one manufacturer and carry a two year warranty.
 - 2. A factory representative shall inspect closers after installation to insure proper adjustment and operation.
 - 3. Closers shall have full hydraulic, rack and pinion action with high strength cast iron cylinder.
 - 4. Spring power shall be adjustable. Spring power shall provide an opening force range of 8 to 15 pounds from 0 degrees to 90 degrees.
 - 5. Closers shall have separate adjustments for latch speed, general speed and back check.
 - 6. Adjustments screws shall be accessible through a heavy duty mounting plate when finish plates are removed.
 - 7. Closers shall be field adjustable to allow precise setting for each door and fitted with a protective shield.
 - 8. Install of the finish plate shall fully conceal all adjustment mechanisms.
 - 9. Closers shall have an extra heavy duty, forged steel concealed arm.
 - 10. The low friction track roller shall be attached to the arm by a threaded mounting.
 - 11. Closers shall have a metal track designed to prevent jamming and to eject foreign objects

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place in the track mortised into the top of the door.

12. Provide brackets, spacer blocks and any accessory required to insure proper installation.
13. Attach with stainless steel security screws.

2.7 POSITION SWITCHES

A. Concealed Door Position Switch:

1. Manufacturer:
 - a. DPS6200/Airteq
 - b. 201020/Brink
 - c. 200MRS/Southern Folger
2. Mortise installation overhead mounting with switch contacts housed in the door frame and actuating magnet mortised into the top of the door.
3. Adjust switch for minimum movement to activate.
4. Locate position switches in frame head, six inches (152 mm), center of switch, from lock edge of door.
5. Fasteners shall be torx-head (star design with center pin) security fasteners.

B. Keeper Switches:

1. Manufacturer:
 - a. Airteq
 - b. Brink
 - c. Southern Folger
2. SPDT limit monitoring switch, rating 10 amps at 120 VAC.
3. All manual locks shall utilize keeper switches.
4. Provide keeper switch model as required by lock mfr.
5. Fasteners shall be torx-head (star design with center pin) security fasteners.

2.8 DOOR ACCESSORIES

A. Push Plates:

1. Series/Manufacturer:
 - a. 1456/Hiawatha
2. 0.125 inch (3.175 mm) thick stainless steel.
3. 3-1/4 inches wide by 15-3/4 inches high (82.55 mm wide by 400 mm high) with 7/8 inch (22.2 mm) lip projection at bottom.
4. Attach with stainless steel security rivets.

B. Pull - Loop:

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1. Series/Manufacturer:
 - a. 612/Airtec
 - b. 300021/Brink
 - c. 212/Southern Folger
 2. Cast bronze, satin chrome plated.
 3. 8-3/4 inches (222 mm) overall length and 2-1/4 inches (57 mm) projection.
 4. Fasteners shall be torx-head (star design with center pin) security fasteners.
- C. Pull - Flush:
1. Series/Manufacturer:
 - a. 614/Airtec
 - b. 300011/Brink
 - c. 214/Southern Folger
 2. Cast bronze, satin chrome plated.
 3. 5 inches high by 4 inches wide by 1 inch deep (127 mm high by 102 mm wide by 25 mm deep), with 1/8 inch (3 mm) thick faceplate.
 4. Fasteners shall be torx-head (star design with center pin) security fasteners.
- D. Door Stops:
1. Black silicone rubber bumper 2 inches (50.8 mm) diameter, mounted on a 5/8 inch by 2-1/2 inches (15.875 mm by 63.5 mm) steel shank for permanent attachment in grout filled masonry or concrete.
- E. Thresholds:
1. Manufacturer:
 - a. 2005AT/Pemko
 - b. Reese
 - c. National
 2. Fasteners shall be stainless steel torx-head (star design with center pin) security fasteners with expansion anchors.
- F. Interlocking Threshold
1. Manufacturer
 - a. 114/Pemko
 - b. Rheese
 - c. National
 2. Provide with matching door bottom hook to provide anti-pass through at door bottom.

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G. Weatherstripping/Smoke Seals:

1. Model/Manufacturer:
 - a. 315CR/Pemko
 - b. DS78C/Reese
 - c. 130NA/National
2. Extruded clear anodized aluminum with neoprene seal.
3. Secured with stainless steel, torx-head (star design with center pin) security screws.

H. Automatic Door Bottom:

1. Model/Manufacturer:
 - a. 4131/Pemko
 - b. Rheese
 - c. National
2. Surface mounted type, clear anodized aluminum, cam-actuated drop down vinyl seal, with spring mechanism return.
3. Secured with stainless steel, torx-head (star design with center pin) security screws.

I. Kick Plates:

1. See drawings for height high by door width with allowance for frame stops.
2. BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard self-tapping screw fasteners.

2.9 FINISHES

	US <u>Symbol</u>	ANSI <u>Symbol</u>	<u>Description</u>
Hinges, Exterior	US32D	630	Satin Stainless Steel
Hinges, Interior	US26D	626	Satin Chrome
Locks & Pulls	US26D	626	Satin Chrome
Closers	AL	689	Aluminum Painted
Push & Kick plates	US32D	630	Satin Stainless Steel
Strike Plates	US32D	630	Satin Stainless Steel

2.10 CYLINDERS, KEYS AND KEYING

- A. The detention locks will incorporate two (2) separate keying systems; one for lever tumbler (Paracentric) and one for pin tumbler (mogul cylinder) locks. Each keying system's keys shall be dye stamped for identification; corresponding to the Detention Equipment Contractor's final schematic keying chart.
- B. Lever tumbler locks shall be keyed alike or different as directed. Provide cut keys as required.

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- C. Mogul cylinder locks shall be master keyed as directed. Provide cut change keys, and master keys as required.
- D. For each individual key cabinet, provide the following:
 - 1. For all individual key designations, there shall be three (3) keys each.
 - 2. For each Master Key designations (A,B,...etc.), there shall be five (5) keys each.
- E. A complete, detailed schematic chart of the keying system will be required. The Detention Equipment Contractor will also be required to enter the key symbols for all doors on additional floor plans which will be supplied by the Architect. Two (2) copies of the schematic keying chart and architectural floor plans shall be turned over to the user at the completion of the project. The cost for this service shall be included with the cost of materials at the time of bidding.
- F. The key schedule is confidential information known only to the Institution, Architect, and lock manufacturer. The Architect shall arrange to meet with the Institution to determine the keying schedule. The lock manufacturer shall deliver keys directly to the Institution (signature required), and provide confirmation of delivery to the Contractor.
- G. Keys shall not leave the manufacturer's custody without prior arrangements for delivery and authorization from the Owner.

2.11 KEY CONTROL

- A. Key control system shall be furnished with a capacity of 1.75 times the number of individual key designations and shall be a complete dual tag system.
- B. Cabinet shall have concealed-type hinge and rounded sides.
- C. Panels must have individual hook and label pockets formed as an integral part of the panel, for both paracentric and mogul key types, as required.
- D. Tags of two types shall be provided, one set for permanent attachment of file key without the use of tools and the other set with snaphook holding at least four keys.
- E. Indexing shall be provided to record information concerning locks and keys alphabetically.
- F. Permanent Loan Registry shall be furnished to protect identity of key borrowers while Receipt Tabs shall be supplied for temporary loan.
- G. Provide key cabinets as follows:
 - 1. Main Control Room:
 - a. Working Storage - Telkee Regent
- H. Provide key control/record software package equal to package offered by Best Locks.

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2.12 DETENTION EQUIPMENT ACCESSORIES

- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
 - 1. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 050553.
 - 2. Finish shall match that specified of the item anchored.

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 electrical power systems to verify actual locations of wiring connections before installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Install Detention Hardware in accordance with shop drawings, manufacturer's written installation instructions, and as herein specified.
- C. Installation shall be under supervision of manufacturer approved personnel.
- D. Mounting Heights: Heights given are center line heights up from finish floor unless stated; heights given "Number to Number" indicate that all shall be at one height within limits given. Where heights of items are not listed, mount in accord with recommendations of DHI.
 - 1. Bottom hinge 10 to 13 inches (254 to 330 mm)
 - 2. Top hinge 6 to 8 inches (152 to 203 mm) down from head
 - 3. Intermediate hinges Equally spaced

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4.	Detention lock	40 inches (1016 mm) to centerline of lockbolt
5.	Door pull	42 inches (1066 mm) to centerline of grip
6.	Flush pull	42 inches (1066 mm) to centerline of grip
7.	Push plate	46 inches (1168 mm) to centerline of plate

- E. Fitting: Fit hardware accurately and properly. Remove exposed parts until after painter's finishing is completed, then reinstall. Securely fasten all fixed parts. Fit faces of mortised parts snug and flush. Make sure operating parts move freely and smoothly without binding, sticking or excessive clearance.
- F. Adjusting and Finishing: After work has been otherwise completed, examine hardware for complete and proper installation. Lubricate bearing surfaces of moving parts. Adjust latching and holding devices to proper function. Adjust door control devices to proper speed and power. Test keys for conformance to approved keying system. Clean exposed surfaces, check for surface damage and polish.
- G. Thresholds: Install in one continuous piece, full width of opening. Set in full bed of mastic and fasten with countersunk anchors at 6 inches (152 mm) on center.

3.3 DEFECTIVE WORK

- A. Where hardware is found defective in materials or installation; rework, restore, replace or otherwise correct as directed.
- B. Following will be considered as defective materials:
 - 1. Unauthorized substitutes.
 - 2. Items delivered with missing, broken, damaged or defaced parts.
 - 3. Items of incorrect hand or function.
- C. Following will be considered as defective installation:
 - 1. Items broken, damaged, or defaced after delivery.
 - 2. Items incomplete, misaligned or incorrectly located.

3.4 SPARE PARTS

- A. Shall be provided for the Owners' stock as follows:
 - 1. 2 Each different type of locks.
 - 2. 6 Mogul Cylinders
 - 3. 6 Swing door Position Switches
 - 4. 6 Keeper Switches
 - 5. Six complete repair parts kit for each different type of the 10120 Series locks, containing: Springs, micro switches, screws, nuts, washers and miscellaneous parts.

3.5 HARDWARE SCHEDULE

- A. Provide hardware, conforming to Specifications herein as scheduled on drawings:

Detention Door Hardware Set No. DH01

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Threshold	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH02

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	1070A
1	Strike with Switch	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
2	Loop Pull	As specified
1	Threshold	As specified
1	Door Stop	As specified
	Number of hinges, as specified.	

Detention Door Hardware Set No. DH03

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified

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1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH04

Single door each to have the following:

Lock Keyed One Side

*	Hinges	204FMSS
1	Lock	10120AM
1	Food Pass Lock	1017AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Loop Pull	As specified
1	Flush Pull	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH05

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AE
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Door Stop	As specified
1	Threshold	As specified
1	Weather Stripping	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH06

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified

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1	Threshold	As specified
1	Auto Door Bottom	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH07

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Food Pass Lock	1017AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Fire seal	AS specified
1	Door Stop	As specified

* Number of hinges, as specified.

Detention Door Hardware Set No. DH08

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Food Pass Lock	1017AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Threshold	As specified
1	Door Bottom	As specified
1	Smoke Seal	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

Detention Door Hardware Set No. DH09

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	204FMSS
1	Lock	10120AM
1	Strike	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified
1	Loop Pull	As specified
1	Push Plate	As specified
1	Interlocking Threshold	As specified
1	Smoke Seal	As specified
*	Number of hinges, as specified.	

Detention Slide Door Hardware Set No. DH10 (refer to 11 19 26)

Single door each to have the following:

Lock Keyed One Side

1	Detention Sliding Door Locking Device	3150LXPK
1	Food Pass Lock	1017AM
1	Loop Pull	As specified
1	Flush Pull	As specified

Detention Door Hardware Set No. DH11 (rated util. chase)

Single door each to have the following:

Lock Keyed Two Sides

*	Hinges	
1	Lock	10514 Moritse Store door function. Latch by lever either side, deadbolt by key either side.
1	Strike with Switch	As specified
1	Concealed Door Position Switch	As specified
1	Closer	As specified

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2	Loop Pull	As specified
1	Threshold	As specified
1	Push Plate	As specified
1	Smoke Seal	As specified
1	Door Stop	As specified
*	Number of hinges, as specified.	

END OF SECTION 111923

SECTION 111926 – DETENTION SLIDING DOOR LOCKING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Electromechanical-locking, electromechanical-door-movement, sliding door device assemblies.
- B. Related Requirements:
 - 1. Division 05 Section “Metal Fabrications”
 - 2. Division 05 Section “Tamper Proof Metal Fasteners”
 - 3. Division 07 Section “Security Joint Sealants”
 - 4. Division 09 Section “Painting”
 - 5. Division 11 Section “General Provisions for Detention work”
 - 6. Division 11 Section “Detention Hollow Metal Doors and Frames”
 - 7. Division 11 Section “Detention Hardware”
 - 8. Division 13 Section “Prefabricated Precast Concrete Cell Modules”
 - 9. Division 26 for Electrical
 - 10. Division 27 for Communications
 - 11. Division 28 for Electronic Safety and Security

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles for each type of detention sliding door locking device.
- B. Shop Drawings: For each type of detention sliding door locking device. Include openings by door number and location, catalog numbers, keying information, materials, elevations, dimensioned construction details, opening conditions, and installation requirements of reinforcement, and connections to detention hollow metal doors. The Architect/Engineer's approval of schedule will not relieve Contractor or Supplier of responsibility for errors or omissions which it might contain.
- C. Certification by Manufacturer: That products supplied complies with performance requirements

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specified.

- D. Qualification Data: For Installer.
- E. Product Test Reports: Showing compliance with specified requirements.
- F. Maintenance Data: For each type of detention door hardware to include in maintenance manuals.
- G. Sample Warranties: For special warranties.
- H. Detention Keying Schedule: Coordinate a Detention Keying meeting with the Architect, User, and hardware supplier so as not to delay the manufacturer and delivery of the required detention locks. Submit keying system schedule after signed approval by User.

1.4 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications
 - 1. General: Refer to Section 111900.
- B. Provide detention sliding door locking devices manufactured by a single firm specializing in the production of this type of work.
- C. Installation and maintenance of the detention sliding door locking devices shall be performed by manufacturer approved personnel. Submit certification of manufacturer training with shop drawings.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention sliding door locking devices per manufacturer's requirements.
- B. Delivery: Deliver items in manufacturer's original package. Each item individually packaged and carefully marked for intended opening and use. Each item complete with necessary screws, bolts, keys, instructions, and where necessary, installation templates.
- C. Storage: Store off floor in dry area of building out of way of other work in progress. Provide maximum protection against loss and damage.
- D. Handling: Handle items in a manner to prevent damage. Marred, defaced, damaged and defective items will be rejected.

1.6 COORDINATION

- A. Electrical System Roughing-in: Coordinate layout and installation of electrified detention sliding door locking devices with connections to power supplies and detention monitoring and control system.

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1.7 WARRANTY

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

1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
- b. Faulty operation of operators.

2. Warranty Period: Two (2) years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Manual: Furnish a bound complete set of maintenance instructions as needed for Owner's continued adjustment, maintenance, repair, and removal and replacement of detention sliding door locking devices.

- B. Training: Provide on-site review of Operational and Maintenance manuals and spare parts with the Owner's designated personnel. Provide sixteen hours of training on repair and maintenance of the detention sliding door locking devices.

1. Provide a professionally produced video tape on the repair and maintenance of the detention sliding door locking devices.

- C. Initial Maintenance Service: Beginning at Substantial Completion, provide at six (6) month intervals (coordinate exact time with the User) per year for the basic warranty period full maintenance by skilled employees of detention sliding door locking devices Installer. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper detention sliding door locking device operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DETENTION DOOR HARDWARE

- A. General: Provide detention door hardware for each detention door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3 in Division 11 Section "Detention Hardware."

2.2 SLIDING DETENTION DOOR DEVICE ASSEMBLIES, GENERAL

- A. Performance Requirements: Provide sliding detention door device assemblies, including locking device, receiver, overhead door hanger, bottom door guide, lock column, and enclosure, as a complete assembly, complying with Grade 1 according to ASTM F 1643, as determined by testing manufacturers' standard units representing those indicated for this Project.

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B. Assembly Construction: As follows:

1. Enclosure: Fabricated from 0.167 inch (4.2 mm) thick steel plate, with 0.123 inch (3.1 mm) thick, steel removable or hinged cover. Baffle openings in enclosure. Provide closures for ends of housings.
 - a. Provide sloping-top housings.
 - b. Provide Flat-top housings where indicated.
2. Lock Column: Vertical tube enclosure fabricated from 0.123 inch (3.1 mm) thick steel, providing mechanical locking control of detention sliding door at door location; operated by paracentric key. Doors shall be capable of being locked at top and bottom, at rear of door, in both open and closed positions, with no components projecting into door opening.
3. Receiver: Fabricated from 0.123 inch (3.1 mm) thick steel plate.
4. Hanger Assembly: Extend steel carrier full width of door and door travel required for clear door opening. Provide antifriction ball-bearing steel rollers with hardened members and grease shield.
5. Finish: Factory prime painted.

2.3 ELECTROMECHANICAL-LOCKING, ELECTROMECHANICAL-DOOR-MOVEMENT, SLIDING DOOR DEVICE ASSEMBLIES

A. Operated from remote-control panel that activates electric motors to unlock sliding doors and motorized rack-and-pinion drive mechanisms to open and close doors. Doors lock in open position and deadlock when closed. Provide factory-wired cable harness with plug connectors for each motor unit.

1. Each door can be individually unlocked locally or from a remote panel or unlocked from a remote panel with other doors as a group. In an emergency or if power fails, door group can be manually operated from pilaster release adjacent to receiving jamb of each door operated by paracentric key; doors shall not relock in any position.
2. Continuous housing for groups of cell doors.
3. Products:
 - a. Airteq; Model 7350.
 - b. Brink; Model 57700.
 - c. Southern Folger; Model 3150L.

2.4 DETENTION EQUIPMENT ACCESSORIES

A. Provide accessories, anchorage inserts and security fasteners for a complete, tamper-proof installation.

B. Exposed Security Fasteners:

1. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 050553.

2. Finish shall match that specified of the item anchored.

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 electrical power systems to verify actual locations of wiring connections before installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Install detention sliding door locking devices in accordance with shop drawings and manufacturer's written installation instructions for proper functioning of sliding door devices.
- C. Installation shall be under full time supervision of manufacturer approved personnel.
- D. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- E. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika and paint equipment to match surrounding materials.

3.3 ADJUSTMENT AND CLEANING

- A. Check and readjust doors and devices just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work.
- B. Clean equipment thoroughly prior to Substantial Completion.

3.4 PROTECTION:

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- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

3.5 SPARE PARTS

- A. Shall be provided for the Owners' stock as follows:
 - 1. Six complete repair parts kit for cell sliding door locking device, containing: Springs, micro-switches, screws, nuts, solenoid valves, fittings, washers and miscellaneous hardware.

END OF SECTION 111926

SECTION 111933 – DETENTION GLASS AND GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Security glazing.
 - 2. Glazing accessories.
 - 3. Tinting film.

- B. Related Requirements:

- 1. Division 11 Section “General Provisions for Detention Work”
 - 2. Division 11 Section “Detention Hollow Metal Doors and Frames”

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)

- 1. ASTM F1915: Standard Test Methods for Glazing for Detention Facilities

- B. National Institute of Justice (NIJ)

- 1. NIJ - 0108.01: Ballistic Resistant Protective Materials

- C. Federal Specifications (FS)

- 1. FS TT-S-230A: Sealing Compound, Synthetic rubber base, single component, chemically curing for caulking, sealing and glazing in building construction
 - 2. FS TT-S-002303: Sealing compound, Elastomeric type, single component (for caulking, sealing, and glazing in buildings and other structures.
 - 3. FS MIL-P46144: Polycarbonate and plastic sheet standards.

- D. Flat Glass Marketing Association (FGMA)

- 1. FGMA: Glazing Manual
 - 2. FGMA: Sealant Manual

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E. National Fire Protection Association (NFPA)

1. NFPA 80 Standard for fire Doors and Other Opening Protectives

1.4 SUBMITTALS

A. Product Data: For each security glazing type and glazing material. Include type of materials, thickness, method of test and performance.

B. Samples:

1. Submit two (2), 12 inch square samples of each type of glass required.
2. Submit three (3), 12 inch long samples of each type of glazing sealant and gasket required.

C. Certification by Manufacturer: That products supplied complies with performance requirements specified.

D. Product Test Reports: Showing compliance with specified requirements.

E. Maintenance Data: Covering cleaning and protection requirements.

F. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Detention Equipment Contractor (DEC) Qualifications

1. General: Refer to Section 111900.

B. Manufacturer Qualifications: Company specializing in the manufacture of security glass, types as specified, with minimum documented five (5) years of experience.

C. Installer Qualifications: Engage an experienced Installer who has specialized in installing security glazing similar to that required for this Project.

D. Certified Safety Glazing: Category II products complying with test requirements of 16 CFR 1201 and ANSI Z97.1, certified by Safety Glazing Certification Council, and permanently labeled.

E. Forced-Entry Resistant Performance: Provide products identical to those tested for compliance with requirements indicated per tests specified for specific glazing types.

1. Have tests performed by qualified independent testing agency.
2. Testing Agencies: Subject to compliance with requirements, acceptable testing agencies are:
 - a. HP White Laboratories, Inc.
 - b. Warnock-Hersey International

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- c. Wiss, Janney, Elstner Associates, Inc.
- d. Underwriters Laboratories, Inc.

- F. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 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.

1.8 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Polycarbonate: Manufacturer agrees to replace laminated polycarbonate that deteriorates within specified warranty period. Deterioration of laminated polycarbonate is defined as defects developed from normal use that are not attributed to maintaining and cleaning laminated polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.

- 1. Warranty Period: Five (5) year from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration of glass-clad polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.

- 1. Warranty Period: Five (5) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

following:

1. Global Security Glazing
2. Insulgard Corporation
3. LTI Smart Glass, Inc.
4. Oldcastle Building Envelope

2.2 SECURITY GLAZING TYPES

- A. Security Glazing Types: Provide types of units fabricated of the glazing products indicated with the security performance specified.

2.3 GLASS-CLAD POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing [Type SG-6D]: clear glass-clad polycarbonate.
1. Forced-Entry Resistance: ASTM F1915, Security Grade 2.
 2. Overall nominal thickness shall be 13/16 inch (20.6375 mm).
 3. Inner and outer lites shall be 1/8-inch (3 mm) tempered, chemically or heat strengthened float glass with a multiply polycarbonate core.
- B. Security Glazing [Type SG-6F]: clear glass-clad polycarbonate.
1. Forced-Entry Resistance: ASTM F1915, Security Grade 1.
 2. Overall nominal thickness shall be 1 inch (25.4 mm).
 3. Inner and outer lites shall be 1/8-inch (3 mm) tempered, chemically or heat strengthened float glass with a multiply polycarbonate core.

2.4 FIRE RATED GLASS-CLAD POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing [Type SG-7G]: Fire resistance rated glass-clad polycarbonate.
1. Forced-Entry Resistance: ASTM F1915 Security Grade 2.
 2. Overall nominal thickness shall be 15/16 inch (23.8125 mm).
 3. Consisting of 1/8-inch (3 mm) tempered, chemically or heat strengthened float glass with a multiply polycarbonate core and fire resistance rated laminated unit, all laminated together.
 4. 60 min fire resistance rated.
- B. Security Glazing [Type SG-7H]: Fire rated glass-clad polycarbonate.
1. Forced-Entry Resistance: ASTM F1915 Security Grade 2.
 2. Overall nominal thickness shall be 15/16 inch (23.8125 mm).
 3. Consisting of 1/8-inch (3 mm) tempered, chemically or heat strengthened float glass with a multiply polycarbonate core and 1/4-inch wire glass (threat side).
 4. Interior applied tinting “film” to be installed after occupancy around all control room areas. Color to be selected by Owner under supervision of Architect.

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2.5 GLAZING ACCESSORIES

- A. General: Provide products of material, size, and shape complying with referenced glazing standard and requirements of manufacturers of 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. Glazing Tape: Pre-cured, 100 percent solids, butyl polyisobutylene rubber with internal spacer rod, complying with AAMA 807.1 tape, as described in AAMA 800-86.
- D. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- E. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glazing unit manufacturer to maintain glazing units in place for installation indicated.
- F. Edge Blocks: Elastomeric material of hardness needed to limit lateral movement (side walking) of glazing units.
- G. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.
- H. Glazing Sealant: Black, neutral-curing silicone complying with ASTM C 920, Grade NS, Type S or M, Class 25, Uses NT, A, G, and O--as applicable to glazing substrates indicated.
- I. Soft Compression Gaskets: Preformed, closed-cell neoprene, complying with ASTM C 509, Type II; shape and density to maintain seal.
 - 1. Color: As selected by the Architect from manufacturer's standard colors.
- J. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.6 TINTING FILM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Madico Window Film/Madico, Inc.
 - 2. LLUMAR Solar Control Window Film/Martin Processing, Inc.
- B. Interior applied tinted film to be installed after occupancy around all control room areas and where indicated.
- C. Color to be selected by Owner under supervision of Architect from manufacturer's standard colors. Provide a minimum of ten (10) 36 inch by 36 inch samples that have been selected from the manufacture's standard colors to allow the Owner to make a final selection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing for glazing, 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 system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glazing-unit-framing members.
 - 5. Check for conditions that would void the manufacturer's warranty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean the glazing channel or other framing members to receive glass immediately before glazing. Remove coatings that are not firmly bonded to the substrate.

3.3 INSTALLATION - GENERAL

- A. Expenses carried by the Architect/Engineer, Project Manager and Owner in troubleshooting Security Glass and Glazing problems, caused by inadequate workmanship or other form of poor performance on the part of a contractor, shall be borne by that Contractor.
- B. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting security glazing problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- C. Comply with combined written instructions of manufacturers of glazing, sealants, gaskets and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- D. Glazing channel dimensions, as indicated on Drawings or determined by glazing material thicknesses and by other requirements indicated, provide necessary bite on lites, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- E. Protect glazing from edge and surface damage during handling and installation. Remove damaged glazing from Project site and legally dispose of off Project site. Damaged glazing are those with edge damage or other imperfections that, when installed, could weaken glazing and impair performance and appearance.
- F. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

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- G. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- H. Do not block weep holes.
- I. Do not exceed edge pressures stipulated by glazing unit manufacturers for installing lites.
- J. Provide spacers for glazing lites where the length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glazing lites. 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 glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- K. Provide edge blocking where indicated or needed to prevent glazing lites from moving sideways in glazing channel, as recommended in writing by glazing unit manufacturer and according to requirements in referenced glazing publications.
- L. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glazing units, their exposed edges are flush with sightline of stops.
- B. Install tapes continuously. Do not stretch tapes to make them fit opening.
- C. 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.
- D. Do not remove release paper from tape until just before each glazing unit is installed.
- E. Place setting blocks at 1/4 points.
- F. Rest glass on setting blocks and press against tape with sufficient pressure to ensure full contact and adhesion at perimeter.
- G. Place glazing tape on free perimeter of glass in same manner described above.
- H. Install removable stop, avoid displacement of tape, exert pressure on tape for full continuous contact.
- I. Knife trim excess or protruding tape.
- J. After installation of stops, apply fillet bead of glazing sealant along entire glazing perimeter on

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both sides of glazing, installed with a substantial "wash" away from the glass, providing a water-tight seal from detergents and cleaning solutions.

3.5 PROTECTION AND CLEANING

- A. Protect all glass from breakage 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 including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash both sides of glazing not more than 4 days before inspection for Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 111933

SECTION 111943 – DETENTION FURNISHINGS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Detention bunks.
 - 2. Detention tables.
 - 3. Detention seating.

- B. Related Requirements:

- 1. Division 04 Section “Unit Masonry Assemblies”
 - 2. Division 05 Section “Metal Fabrications”
 - 3. Division 05 Section “Tamper Proof Metal Fasteners”
 - 4. Division 07 Section “Security Joint Sealants”
 - 5. Division 09 Section “Painting”
 - 6. Division 11 Section “General Provisions for Detention Work”

1.3 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 detention furnishing indicated.

- B. Shop Drawings: For each type of detention furnishing.

- 1. Include plans, elevations, sections, details, and attachments to other Work.

- C. Coordination Drawings: Drawings of each built-in anchor supporting detention furnishings, including those to be installed as work of other Sections, drawn to scale and coordinating anchorage with detention furnishings. Show the following:

- 1. Locations, dimensions, and profiles of wall and floor reinforcements.
 - 2. Locations and installation details of built-in anchors.
 - 3. Elevations of each detention furnishing showing dimensions of furnishing, preparations for receiving anchors, and locations of anchorage.
 - 4. Details of attachment of each detention furnishing to built-in anchors.

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- D. Samples: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

1.4 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications
 - 1. General: Refer to Section 111900.
- B. Provide detention furnishings and equipment manufactured by a single firm specializing in the production of this type of work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention furnishings and equipment per manufacturer's requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER OF DETENTION FURNISHINGS AND EQUIPMENT

- A. Acceptable Manufacturers:
 - 1. American Jail Products; Troy, NY
 - 2. Jails Correctional Products; Minster, OH
 - 3. Majestic Solutions, Inc.; Madison, AL
 - 4. Maximum Security Products Corp.; Albany, NY
 - 5. Norix Group, Inc.; West Chicago, IL
 - 6. Southern Steel Company; San Antonio, TX
 - 7. Sweeper Metal Fabricators Corp.; Drumright, OK
 - 8. Viking Products; Orange, CA

2.2 DETENTION BUNKS

- A. Double Bunk Bed (Floor Mounted):
 - 1. Construction:
 - a. 0.1875 inch by 2 inches by 2 inches (4.76 mm by 51 mm by 51 mm) steel angle support frame and 1/4 inch (6 mm) plates with holes welded to bottom end of legs for floor mounting.
 - b. 0.1345 inch (3.42 mm) sheet pan with longitudinal flanges to be turned back and hemmed full length of bunk pan.
 - c. Provide security type, wedge anchors for fastening to floor.
 - 2. Size: 80 inches length by 27 inches width by 60 inches height (2032 mm length by 685.8 mm width by 1524 mm height).

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3. Bunk bed assembly shall be provided with one (1) shop coat of primer. Field finish paint by Section 099123, color as selected by Architect. Verify primer compatibility with finish paint as specified in Section 099123.
4. Provide low-mod gel, equal to Sikadur 23 by Sika, around perimeter of bunk legs and floor.

2.3 DETENTION TABLES

A. Dayroom Table Pedestal with Individual Seats:

1. Construction:
 - a. Size of four (4) man dayroom table unit to be 66 inches by 66 inches (1676 mm by 1676 mm) with table height of 30 inches (762 mm). Tabletop to be 40 inches by 40 inches (1016 mm by 1016 mm) and seat top to be 12 inches (305mm) in diameter. Cut tabletop corners at 45 degrees.
 - b. Tabletops and seats to be smooth, true, level, and free of sharp edges.
 - c. Fabricate tabletop from 9/64 inch steel (3.57 mm) and seat from 1/16 inch (2 mm) stainless steel.
 - d. Tabletop to be reinforced with 18 inches by 18 inches by 1/4 inch plate (457 mm by 457 mm by 6 mm). Seats to be reinforced per stool specification.
 - e. Supports to be 4 inches by 4 inches by 3/16 inch (102 mm by 102 mm by 4.8 mm) tubing.
 - f. Base plate at floor to be 18 inches by 18 inches by 3/8 inch (457 mm by 457 mm by 9.5 mm) plate drilled for security fasteners for anchoring table to the floor.
2. Provide anchorage devices and security fasteners as detailed.
3. Table to be continuous welded and finish ground, eliminating sharp corners and edges.
4. Steel components shall be provided with one (1) shop coat of primer. Field finish paint by Section 099123, color as selected by Architect. Verify primer compatibility with finish paint as specified in Section 099123. Stainless steel shall be type 304 with a No. 3 finish.

2.4 DETENTION SEATING

A. Detention Chair:

1. Product/Manufacturer:
 - a. Razorback Chair / Cortech USA; Willowbrook, Illinois
2. Construction:
 - a. Material: High Impact Polypropylen
 - b. 1,500 lb. Static Load

2.5 DETENTION EQUIPMENT ACCESSORIES

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- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
 - 1. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 050553.
 - 2. Finish shall match that specified of the item anchored.

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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Comply with manufacturer's printed installation instructions.
- C. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- D. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika.

3.3 CLEANING

- A. Clean equipment thoroughly prior to Substantial Completion.

3.4 PROTECTION

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- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111943

SECTION 111946 – DETENTION TOILET 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. Detention mirror with embedded mounting plate.
 - 2. Detention safety hooks.
 - 3. Detention grab bars.
 - 1. Break-A-Way Track, Safety Tabs and Shower Curtains
- B. Related Requirements:
 - 1. Division 04 Section “Unit Masonry Assemblies”
 - 2. Division 05 Section “Metal Fabrications”
 - 3. Division 05 Section “Tamper Proof Metal Fasteners”
 - 4. Division 07 Section “Security Joint Sealants”
 - 5. Division 09 Section “Painting”
 - 6. Division 11 Section “General Provisions for Detention Work”

1.3 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 detention toilet accessories indicated.
- B. Shop Drawings: For each type of detention toilet accessories.
 - 1. Include plans, elevations, sections, details, and attachments to other Work.

1.4 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications
 - 1. General: Refer to Section 111900.
- B. Provide detention toilet accessories manufactured by a single firm specializing in the production

of this type of work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention toilet accessories per manufacturer's requirements.

PART 2 - PRODUCTS

2.1 DETENTION MIRROR WITH EMBEDDED MOUNTING PLATE

A. Detention Mirror with Embedded Mounting Plate

1. Model/Manufacturer:
 - a. Norix Group, Inc.; West Chicago, IL
 - b. Southern Steel Company; San Antonio, TX
 - c. Sweeper Metal Fabricators Corp.; Drumright, OK
 - d. Viking Products; Orange, CA
2. Mirror:
 - a. Mirror frame dimensions shall be minimum 12 by 16 inches (305 by 406 mm), fabricated from 0.0625 inch (1.59 mm) nominal-thickness, chrome-plated steel sheet.
 - b. Mirror opening shall be minimum 10 by 14 inches (254 by 355.6 mm). Mirror shall be made of 0.0394 inch (1.0 mm) thick stainless steel
 - c. Include chromium plated security fasteners.
3. Embedded Mounting Plate:
 - a. Embedded mounting plate to be constructed of 1/4 inch (6 mm) plate steel.
 - b. Embed plate shall be drilled and tapped for security fasteners.
 - c. Embedded mounting plate shall be provided with one (1) shop coat primer.
4. Mount top of mirror at 74 inches (1879.6 mm) above finish floor.
5. Provide low-mod gel, equal to Sikadur 23 by Sika, around perimeter of frame and embed.

B. Detention Mirror with Embedded Mounting Plate – Accessible Cell

1. Model/Manufacturer:
 - a. Norix Group, Inc.; West Chicago, IL
 - b. Southern Steel Company; San Antonio, TX
 - c. Sweeper Metal Fabricators Corp.; Drumright, OK
 - d. Viking Products; Orange, CA
2. Mirror:

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- a. Mirror frame dimensions shall be minimum 12 by 31 inches (305 by 788 mm), fabricated from 0.0625 inch (1.59 mm) nominal-thickness, chrome-plated steel sheet.
 - b. Mirror opening shall be minimum 10 by 29 inches (254 by 736.6 mm). Mirror shall be made of 0.0394 inch (1.0 mm) thick stainless steel
 - c. Include chromium plated security fasteners.
3. Embedded Mounting Plate:
 - a. Embedded mounting plate to be constructed of 1/4 inch (6 mm) plate steel.
 - b. Embed plate shall be drilled and tapped for security fasteners.
 - c. Embedded mounting plate shall be provided with one (1) shop coat primer.
4. Mount unit so that bottom edge of reflecting surface is 40 inches (1016 mm) above finish floor.
5. Provide low-mod gel, equal to Sikadur 23 by Sika, around perimeter of frame and embed.

2.2 DETENTION SAFETY HOOKS

A. Clothes Hook Strip and Embed Plate:

1. Model/Manufacturer:
 - a. 1828/Acorn Engineering Co.
 - b. 129/American Specialties, Inc.
 - c. S565-531/ Norix Group, Inc.
 - d. SHB-601/PSI LLC.
 - e. HB1400/Viking Products
2. Construction:
 - a. Provide 0.074 inch (2 mm), satin finish, type 304 stainless steel plate with stainless steel, ball-type collapsible hooks.
 - b. Provide embed plate, drilled and tapped for security fasteners, with anchor straps.
3. Provide pivoting assembly that maintains pressure on hook and snaps down when load exceeds 8 lbf (35.6 N).
4. Mount top of plate at 48-1/2 inches (1232 mm) above finish floor.
5. Provide low-mod gel, equal to Sikadur 23 by Sika, around perimeter of plate and embed.

2.3 DETENTION GRAB BARS

A. Detention Grab Bars (Stainless Steel):

1. Model/Manufacturer:
 - a. US130-A Series/A&J Washroom Accessories
 - b. SA70 Series/Bradley Corp.

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- c. IGS/Norix Group, Inc.
- d. GB-600/PSI LLC.
- e. GB/Viking Products

2. Construction:

- a. 1-1/2 inches (38.1 mm) in diameter; formed from 0.038 inch (0.95 mm) thick, stainless-steel tubing, with 3 inch (76.2 mm) diameter flanges formed from 0.125 inch (3.18 mm) thick, stainless steel. Anti-ligature closure plates formed from 0.125 inch (3.18 mm) thick, stainless steel. All-welded construction.

- 3. Length: As indicated on Drawings.
- 4. Mounting: Front mounting with security fasteners.
- 5. Mount top of grab bar at 33 to 36 inches (838.2 to 914.4 mm) above finish floor.
- 6. Provide low-mod gel, equal to Sikadur 23 by Sika, around perimeter of grab bar plates and at all joints.

2.4 BREAK-A-WAY TRACK, SAFETY TABS AND SHOWER CURTAINS

A. Manufacturer:

- 1. Imperial Fastener Company

B. Extruded Aluminum Track:

- 1. IFC-69 Break-A-Way track shall be extruded 6063-T5 aluminum, 1-7/16" by 1-9/16" by .062" wall thickness, one piece, and ceiling mounted.
- 2. Finish: Satin anodized.

C. Track Accessories:

- 1. Safety Tabs 4" long and 3/4" wide. Provide three Safety Tabs per foot.

D. Break-A-Way Shower Curtains:

- 1. Curtain fabric color as selected by Architect.
- 2. Curtain to have 1-1/2" loop tape sewn to top hem.
- 3. Mesh Top: No. 50, 20" wide, 1/2" hole nylon mesh.
- 4. Clear Panel: At bottom.

E. Shower Curtain Fabrication:

- 1. Fabricate Break-A-Way shower curtains to comply with the following requirements:
 - a. Width equal to track length from which shower curtain is hung plus 6 inches added fullness.
 - b. Length equal to floor-to-ceiling height minus distance above the finished floor at bottom as follows:

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1) Shower curtain: 2 inches

- c. Top Hem: To be 1-1/2" wide and double lock stitched and 1-1/2" wide loop tape double lock stitched to top hem.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666 or ASTM A 240/A 240M, austenitic stainless steel, Type 304.
- C. Stainless-Steel Tubing: ASTM A 1016 /A 1016M-08, austenitic stainless steel, Type 304, seamless.

2.6 FINISHES

- A. Embed plate shall be provided with one (1) shop coat of primer. Field finish paint by Section 099123, color as selected by Architect. Verify primer compatibility with finish paint as specified in Section 099123.
- B. Stainless-Steel Finish:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - b. Directional Satin Finish: No. 4.
 - c. Mirrorlike Reflective, Nondirectional Polish: No. 8.
- C. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

2.7 DETENTION EQUIPMENT ACCESSORIES

- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
1. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 050553.
 2. Finish shall match that specified of the item anchored.

PART 3 - EXECUTION

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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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Comply with manufacturer's printed installation instructions.
- C. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- D. Fill voids between materials of the detention toilet accessories and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika.

3.3 CLEANING

- A. Clean equipment thoroughly prior to Substantial Completion.

3.4 PROTECTION

- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111946

SECTION 111963 – DETENTION HOLLOW METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Detention hollow metal wall panels.

- B. Related Requirements:

- 1. Division 03 Section “Cast-In-Place Concrete”
 - 2. Division 05 Section “Metal Fabrications”
 - 3. Division 05 Section “Tamper Proof Metal Fasteners”
 - 4. Division 07 Section “Security Joint Sealants”
 - 5. Division 09 Section “Painting”
 - 6. Division 11 Section “General Provisions for Detention Work”
 - 7. Division 13 Section “Prefabricated Precast Concrete Cell Modules”

1.3 PERFORMANCE REQUIREMENTS

- A. Detention hollow metal wall panels for this Contract shall be constructed as specified and to meet the following tests. An independent testing laboratory shall perform the tests described below, with data attesting to construction of the door and frame. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.

- 1. Wall Assembly Impact Test performed in accordance with ASTM F 2322

- a. Scope and Significance

- 1) This test method is a simulated service test for determining the performance characteristics of walls designed to incarcerate inmates in detention and correctional institutions. The testing provides for the setup and impact testing of a sample wall.

- b. Test Sample

- 1) A wall consisting of two 8 feet by 8 feet (2438 mm by 2438 mm) wall sections shall be constructed in accordance this specification.

c. Test Requirements

- 1) Subject one location on the sample wall to 600 blows equally divided between a sharp and a blunt impactor. The blunt impactor shall deliver the required impacts at 200 foot pounds per impact while the sharp impactor shall deliver the required impacts at 100 foot pounds per impact to the sample location. Repeatability of impact location during each series shall be no more than +/- 2 inches (50 mm) horizontally and vertically from the designated impact target. Testing shall take no longer than 60 minutes. Specimen fails if a 5 inch by 5 inch by 8 inch (127 mm by 127 mm by 203 mm) rectangular box can pass through the wall following impacts.

2. Wall De-lamination Test

a. Scope and Significance

- 1) This test documents the overall integrity of the panel system, resistance to possible de-lamination, and prevention of bulging of panels during grout application.

b. Test Sample

- 1) A wall consisting of a 4 feet by 4 feet (101.6 mm by 101.6 mm) sample shall be constructed in accordance with this specification. No end closing pieces are to be used in this test.

c. Apparatus

- 1) Using a steel I-beam table capable of withstanding a load of 10,000 pounds with no deflection, fix to the tabletop a steel I-beam enclosure to accommodate the sample.

d. Procedure

- 1) Mount the sample in the test fixture and weld the bottom face sheet at its center to the I-beam tabletop.
- 2) Weld a 3 inches by 3 inches (76.2 mm by 76.2 mm) 0.250 inch (6.4 mm) thick steel plate centered horizontally and vertically to the top face sheet. Center on the 3 inches by 3 inches (76.2 mm by 76.2 mm) 0.250" (6.4 mm) thick steel plate an eyelet.
- 3) Using a hydraulic porta-power and a calibrated load cell to measure pounds force, pull on the eyelet in an upward direction.
- 4) Use a dial indicator to measure the deflection at the center of the sample.

e. Pass/Fail Criteria

- 1) Apply 3000 pound load and measure the deflection. The maximum deflection allowable is 0.125 inch (3.2 mm).

3. Bullet Resistance Test

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- a. Bullet resistance shall be tested under UL Standard 752 by an accredited test laboratory. The bullet resistance rating shall be Level 8.
- 4. Cell Furnishing Static Load Test
 - a. Scope
 - 1) This test simulates a wall panel's resistance to bending when loads are applied to cell furnishings.
 - b. Significance of Use
 - 1) The primary purpose of this test is to approximate the levels of pressure apparent when an inmate jumps on the outer edge of a bunk, desk or stool.
 - c. Test Sample
 - 1) Erect a wall or use the same wall as specified under the Wall Impact Test consisting of three 3 feet by 8 feet (914 mm by 2438 mm) panels constructed in accordance this specification.
 - d. Apparatus
 - 1) Attach the piece of furniture by typical means (bolting or welding) to the wall panel system.
 - e. Procedure
 - 1) Apply a load to the outer edge of the furniture item using a hydraulic porta-power and a load cell to measure pounds force. Apply 1,500 pounds.
 - f. Pass/Fail Criteria
 - 1) No permanent visible disfigurement is allowed to the wall panel system.
- 5. Acoustical Tests
 - a. Erect a wall or use the same wall as specified under the Wall Impact Test consisting of three 3 feet by 8 feet (914 mm by 2438 mm) panels constructed in accordance this specification.
 - b. Conduct these tests in accordance with: ASTM E90 Standard Test Classification for Determination of Sound Transmission Class (minimum STC class rating of 45-49), and ASTM E1332 Standard Test Classification for Determination of Outdoor-Indoor Transmission Class (minimum OITC class rating is 41).

1.4 SUBMITTALS

A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, core descriptions, label compliance,

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fire-resistance rating, and finishes for each type of detention panel specified.

B. Shop Drawings:

1. Show panel elevations and sections.
2. Show listing of opening descriptions including locations, material thicknesses and mounting system.
3. Show location and details of all openings.

C. Samples:

1. Panel: 12 inches by 12 inches (305 mm by 305 mm) corner section showing internal construction.
2. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by the samples can be cause for rejection of the work.

D. Certification by Manufacturer: That products supplied complies with performance requirements specified.

E. Product Test Reports: Showing compliance with specified requirements.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Detention Equipment Contractor (DEC) Qualifications

1. General: Refer to Section 111900.

B. Provide detention hollow metal panel manufactured by a single firm specializing in the production of this type of work.

C. Installation shall be under supervision of manufacturer-approved personnel.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle hollow metal work per manufacturer's requirements.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer and installer

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agreeing to repair or replace materials furnished under this Section that fail in materials or workmanship within the specified warranty period. Submit the warranty to the Architect for approval.

- C. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER OF DETENTION HOLLOW METAL WALL PANELS

A. Acceptable Manufacturers:

1. Habersham Metal Product Co.; Cornelia, Georgia
2. Trussbilt Inc.; St. Paul, MN
3. American Steel Products, Swainsboro, GA
4. Sweeper Metal Products, Drumright, OK
5. Willo Products, Decatur, AL

2.2 HOLLOW METAL WALL PANELS

A. Materials

1. Panel face sheets, mounting angles, channels and cover plates shall be constructed of 0.093 inch (2.3 mm) nominal thickness and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653 M Commercial Steel (CS), coating designation A60 (Z180). The steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall also be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
2. Corner plates, top channels, wall channels and angles shall be constructed of 0.123 inch (3.12 mm) minimum thickness steel and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M Commercial Steel (CS), coating designation A60 (Z180).
3. Floor mounting channels shall be constructed of 0.123 inch (3.12 mm) minimum thickness stainless steel meeting ASTM A240/A240M.
4. All panels shall be fully grouted in the field by the wall panel manufacturer. Grout specifications shall be the manufacturer's proprietary design which meets or exceeds all requisite testing per performance requirements, structural and seismic requirements, fire resistance and STC ratings specified for this project.

B. Construction

1. All panels shall be of the types and sizes shown on the approved submittal drawings, shall be constructed in accordance with the specifications and shall meet the performance requirements.
2. Panel face sheets shall be joined at their vertical edges by a continuous rabbeted joint extending the full height of the panel.
3. Panel thickness shall be 2 inches (50 mm) minimum and furnished with grout holes along

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the top edge for grouting in place at the job site. After grouting, grout holes will be concealed by a coverplate. Panels shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the thickness of material used.

4. Panels shall be stiffened by one of the following systems:
 - a. Rolled or formed 1/8 inch (3.2 mm) mild steel channels extending from top to bottom of panel and continuous from one face to the other, spaced not more than 4 inch (101.6 mm) on center and welded to both panel faces not more than 3 inches (76.2 mm) on center vertically.
 - b. Continuous steel truss design core material, 0.015 inch (0.4 mm) minimum mild steel, having truncated triangular sections extending continuously from one panel face to the other, spot welded to each face sheet 2-3/4 inches (69.9 mm) on center horizontally and 3 inches (76.2 mm) on center vertically. Core material shall extend the full height and width of the panel.

2.3 FINISH

- A. Refer to Division 9 – Finishes, Section 09900 Special Coatings
- B. After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make face sheets, vertical edges and weld joints free from irregularities. After appropriate metal preparation, all exposed surfaces of panels shall be factory primed with Prime Coat Corporation (847.972.2141) PC 105 as manufactured by Rock-Tred Corporation (224.377.6048) or Vanberg Coatings (913.599.5939). Primer shall meet ASTM B 117 Salt Spray for 150 hours with a rust grade of not less than 6 as defined in ASTM D 610; and ASTM D 1735 Water Fog Test for organic coatings for 200 hours with any quantity of #8 blisters but no more than “few” #6 blisters as illustrated in ASTM D 714.

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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Inspect floor slab to ensure it is compliant with project and engineering standards.
- C. Prior to installation, all panels, mounting channels and angles shall be checked for size and staged at the appropriate locations.
- D. Install floor channels with fasteners and ceiling angles as required by approved submittal drawings and manufacturer's installation instructions.
- E. Weld panels to floor channels, wall and ceiling mounting angles and weld panel seams as required by engineering documentation and manufacturer's recommendations. Exposed field welds shall be finished smooth and touched up with a rust inhibitive primer prior to security filler.
- F. Caulk/fill between welds using a two-part 100% solids epoxy filler (Prime-Coat Invisajoint Filler or approved Equivalent). All panel to panel joints are to be sanded smooth and shall appear seamless after finish painting is applied.
- G. Panel installation tolerances:
 - 1. Wall panel plumbness: 1/8 in. in 10 ft.
 - 2. Vertical alignment with mezzanine panels: ¼ in.
 - 3. Panel to panel face alignment: 1/16 in.
 - 4. Weld length: + ½ in.; -0 in.
 - 5. Weld spacing: +/- ½ in.
 - 6. Wall straightness: +/- ½ in. in 80 ft.
- H. After installation, wall panels and frames shall be fully grouted by the panel manufacturer. Grout mix and slump to be per the manufacturer's recommendations. Refer to NAAMM HMMA-820 TN01-03 for the proper grouting of frames.
- I. Any grout or other bonding material shall be cleaned off of panels immediately following installation. Exposed panel surfaces shall be kept free of grout, tar, or other bonding material or sealer.
- J. Install all furnishings per approved submittal drawings and manufacturer's installation instructions.
- K. Primed or painted surfaces which have been scratched or otherwise marred during installation (including field welding) and/or cleaning shall promptly be finished smooth, cleaned, treated for maximum paint adhesion and touched up with a rust inhibitive primer comparable and compatible to shop applied primer.
- L. Finish paint interior cell walls with Prime Coat PC 509 with anti-microbial or approved finish coat as manufactured by Rock-Tred Corporation (224.377.6048) or Vanberg Coatings

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(913.599.5939). Paint damage occasioned by installation of cell furniture, plumbing, electrical or other trades shall be corrected by the firm having responsibility for finish painting under section 09900.

- M. Clean and remove debris, leaving cells ready for installation of plumbing, electrical, heating/ventilating, furniture and other trades or materials.

3.3 PROTECTION

- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111963

SECTION 111966 – DETENTION ENCLOSURES

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. Detention security mesh assemblies.
- B. Related Requirements:
 - 1. Division 03 Section “Plant-Precast Structural Concrete”
 - 2. Division 03 Section “Plant-Precast Architectural Concrete”
 - 3. Division 04 Section “Unit Masonry Assemblies”
 - 4. Division 05 Section “Metal Fabrications”
 - 5. Division 05 Section “Tamper Proof Metal Fasteners”
 - 6. Division 07 Section “Security Joint Sealants”
 - 7. Division 09 Section “Interior Painting”
 - 8. Division 11 Section “General Provisions for Detention Work”
 - 9. Division 11 Section “Detention Hollow Metal Doors and Frames”
 - 10. Division 11 Section “Detention Hardware”
 - 11. Division 11 Section “Detention Sliding Door Locks Devices”
 - 12. Division 11 Section “Pneumatic Air Locking System”
 - 13. Division 26 for Electrical
 - 14. Division 27 for Communications
 - 15. Division 28 for Electronic Safety and Security

1.3 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 detention enclosure indicated.
- B. Shop Drawings: For each type of detention enclosure. Include plans, elevations, sections, details, and attachments to other Work. Indicate type of steel for each detention enclosure component.
 - 1. Indicate requirements for cast-in anchors to be installed as work of other Sections.

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- C. Coordination Drawings: Drawings of each opening in detention enclosures, drawn to scale and coordinating detention door hardware. Show the following:
 - 1. Locations, dimensions, and profiles of detention door hardware reinforcements.
 - 2. Locations and installation details of detention door hardware.
 - 3. Details of each detention enclosure frame.
- D. Samples: **12 by 12 inches (305 by 305 mm)** cut-away corner section of woven-rod-mesh assembly, constructed of specified framing and woven-rod panel, showing fabrication techniques and workmanship.
- E. Material Certificates: For homogeneous tool-resisting steel, signed by manufacturers, indicating compliance with performance requirements for complete test sequence according to applicable ASTM standard.
- F. Mill Certificates: For homogeneous tool-resisting steel rods, certifying that rods were fabricated from material with same chemical and physical properties as material used to fabricate homogeneous tool-resisting steel round bars.

1.4 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications:
 - 1. General: Refer to Section 111900.
- B. Provide detention enclosures manufactured by a single firm specializing in the production of this type of work.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing homogeneous tool-resisting steel, as documented according to ASTM E 548.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1) AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- F.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention material per manufacturer's requirements.
- B. Protect units and finishes from damage during shipping, storage, handling, installation and construction of other work in the same area.

1.6 PROJECT CONDITIONS

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- A. Field Measurements: Verify detention enclosure openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating detention enclosures without field measurements. Coordinate wall and floor construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 COORDINATION

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

PART 2 - PRODUCTS

2.1 SECURITY WIRE MESH ASSEMBLIES

- A. Security Mesh Acceptable Manufacturers
 - 1. Alabama Metal Industries Corporation (AMICO), 3245 Fayette Avenue u Birmingham, Alabama 35208; 800-366-2642.
 - 2. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360.
 - 3. Niles International, 310 North Pleasant Ave., Niles, Ohio 44446; 800-321-2727.
- B. Material
 - 1. The super max security flattened expanded metal Security Mesh used shall conform to the following specification:
 - a. Carbon steel – meet or exceed ASTM A-1011
 - b. 9 diamonds per foot
 - c. Mesh size opening –.75 x 9F
 - d. Mesh strand thickness – 0.120 inch
 - e. Weight – 1.71 pounds per square foot
 - f. Prime painted in preparation for field finish paint.
 - g. Similar to AMICO ASM .75 -9F HM.
- C. Mesh panel framing.
 - 1. METALS
 - a. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or

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blemishes.

- b. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- c. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- d. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.2 FABRICATION, GENERAL

- a. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- b. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- c. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- d. Form exposed work with accurate angles and surfaces and straight edges.
- e. Weld corners and seams continuously to comply with the following:
 - 1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2) Obtain fusion without undercut or overlap.
 - 3) Remove welding flux immediately.
 - 4) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- f. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- g. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- h. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- i. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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 detention enclosures.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention enclosure connections before detention enclosure installation.
 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of detention enclosures.
- B. Inspect built-in and cast-in anchor installations before installing detention enclosures to verify that anchor installations comply with requirements. Prepare inspection reports.
1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Re-inspect after repairs or replacements are made.
 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Verify locations of detention enclosures with those indicated on Coordination Drawings.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. General: Install detention enclosures plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings, Coordination Drawings, and manufacturer's written recommendations.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing detention enclosures to in-place construction. Include threaded fasteners for concrete and masonry inserts, security fasteners, and other connectors.
1. Proprietary Built-in Masonry Anchors: Install anchors integral with unit masonry. Comply with requirements in Division 4 Section "Unit Masonry Assemblies."
- D. Cutting, Fitting, and Placement: Obtain manufacturer's written approval for cutting, drilling, and fitting required for installing detention enclosures. Set detention enclosures accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry or similar construction.
- F. 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.

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- G. 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.

- H. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika.

3.3 INSTALLATION OF BAR-GRILLE ASSEMBLIES

- A. Wall and Ceiling Anchorage: Weld framing to continuous angles with continuous welds. Anchor angles to embedded anchors by welding.
- B. Partitions: Weld adjacent framing members to each other with continuous **1/4 inch (6 mm)** deep welds on both sides; grind smooth.
- C. Adjust doors to operate easily without binding.

3.4 INSTALLATION OF WOVEN-ROD-MESH ASSEMBLIES

- A. Floor Anchorage: Fasten anchor clips to floor with **3/8 inch (9.5 mm)** diameter bolts with double-expansion shields.
- B. Wall and Ceiling Anchorage: Fasten continuous anchor angle to walls and ceilings with **3/8 inch (9.5 mm)** diameter, security-type, double-expansion anchor bolts with "break-off" heads.
1. Weld main framing to wall and ceiling angles with **1 inch (25 mm)** welds at **12 inches (305 mm)** on center.
- C. Weld adjacent main framing members to each other with **1/4 inch deep by 3/4 inch (6 mm by 19 mm)** long welds at **12 inches (305 mm)** on center on both sides of framing.
- D. Provide supplementary framing at three-way connections and multiple-panel-height partitions. Weld main framing to supplementary framing with **1/8 inch (3 mm)** fillet welds **1 inch (25 mm)** long at **12 inches (305 mm)** on center on both sides of framing.
- E. Provide additional field bracing as shown or necessary for rigid, secure installation.
- F. Adjust doors to operate easily without binding.

3.5 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports

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and indicate compliance with and deviations from the Contract Documents.

- B. Remove and replace detention work where inspections indicate that work does not comply with specified requirements.
- C. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- D. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.6 CLEANING AND PROTECTION

- 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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 111966

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.

1.2 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.
- C. Samples for Initial Selection: For each type of material exposed to view.

1.3 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
1. Front: Straight, slightly eased at top.
 2. Backsplash: Straight, slightly eased at corner.
 3. Endsplash: Matching backsplash.
- B. Countertops: ~~3/4-inch-~~ (19-mm-) thick, solid surface material with front edge built up with same material.
- C. Backsplashes: ~~3/4-inch-~~ (19-mm-) thick, solid surface material.

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- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.2 COUNTERTOP MATERIALS

- A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- B. Adhesives: Adhesives shall not contain urea formaldehyde.
- C. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avonite, Inc.
 - b. Durasein.
 - c. E. I. du Pont de Nemours and Company.
 - d. Formica Corporation.
 - e. Nevamar Company, LLC; Decorative Products Div.
 - 2. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of solid-surfacing materials complying with the following requirements:
 - a. Basis-of-Design Product: As indicated on Interior Finish Legend on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 1. Install endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

END OF SECTION 123661

SECTION 133419 - PRE-ENGINEERED METAL BUILDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes furnishing and installing Pre-Engineered Metal Building for warehouse complete including rigid frames and other framing members, roof and wall panels, liner panels, purlins, girts, and other subframing members, vapor barrier and insulation, flashings, trim, louvers, and miscellaneous accessories indicated on the contract documents and as specified herein. Metal doors and frames, windows, and overhead rolling door are specified in other sections.

1.2 REFERENCES

- A. FBC - Florida Building Code, latest Edition.
- B. Specification for Structural Steel Buildings (ANSI/AISC 360-16), Allowable Stress Design and Plastic Design, June 1, 1989, and the Commentary on the AISC Specification, June 1, 1989, and the Code of Standard Practice for Steel Buildings and Bridges, March 7 2000, as specified in the AISC Manual of Steel Construction, 15th edition, unless shown on the drawings or specified otherwise herein.
- C. American Welding Society, AWS D1.1 - Structural Welding Code, 2016 Edition.
- D. AISI - Specification for the Design of Cold-Formed Steel Structural Members, 2012.
- E. MBMA - Low Rise Building Systems Manual, 1996.

1.3 SYSTEM DESCRIPTION

- A. Building components to withstand Building Dead Loads, Collateral Loads, Floor and Roof Live Loads, Roof Snow Loads, and Wind Loads due to pressure and suction of wind calculated in accordance with Georgia Building Code, latest Edition.
 - 1. Building Dead Load - Actual Loads.
 - 2. Roof Live Load - 20 psf.
 - 3. Wind Load - See plans.
 - 4. Seismic Load - See plans.
 - 5. Collateral Loads: 5 psf.
- B. Deflection: Deflection of members when subjected to the applicable Design Loads and Collateral Loads specified shall not exceed the limits specified below:
 - 1. Girts - L/180 of span.
 - 2. Purlins - L/180 of span.
 - 3. Frames (vertical loads) - L/180 of span.
 - 4. Frames (lateral loads) - L/300 of eave height.
 - 5. Lateral Building Drift - Match Frame Drift

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- C. Assembly shall permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of -20° to +120° F. Provide sliding roof panel clips.
- D. Pre-Engineered Metal Building Components shall be of type indicated on Drawings, and shall be provided by one manufacturer. Framing 3/16" thick and thicker shall conform to AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Framing less than 3/16" thick shall conform to AISI Specification for the Design of Cold-Formed Steel Structural Members.
- E. Criteria and framing indicated in the specifications and on the drawings shall be considered a minimum standard. The pre-engineered metal building manufacturer shall add additional members or requirements in order to produce a complete pre-engineered metal building roof and wall system that meets or exceeds the code requirements.

1.4 SUBMITTALS

- A. Manufacturers Catalog Data or other descriptive data of miscellaneous accessories, fasteners, joint sealing material; including printed installation instructions and details; and factory color protective coatings.
- B. Submit approval drawings of structural steel, roof and wall covering, flashing, trim, closures, and methods of thermal expansion control, to be checked and approved prior to proceeding with fabrication.
- C. Indicate building dimensions, general construction details, anchorages and method of anchorage, and method of installation, including framing, anchor bolt settings, sizes, and locations from datum.
- D. Submit shop drawings with structural calculations justifying design under seal of a professional structural engineer registered in the State of Georgia. Submittal shall include frame, column and bracing reaction diagrams for all load cases and load combinations.
- E. Welding of all steel in field shall be done by certified welders qualified in accordance with "Qualification of Welding Procedure - Welders and Welding Operators" of the AWS Code of Welding in Building Construction (AWS D1.0). Submit letter indicating current qualification (within past 12 months) for each welder.
- F. Submit Test Reports of all tests required by referenced publications applicable to the particular item or material furnished for use.
- G. Warranty:
 - 1. Weathertightness.
 - 2. Panel Finish.

1.5 QUALITY ASSURANCE

- A. Components shall be the design of a manufacturer regularly engaged in the fabrication of pre-engineered structures. All materials shall be new, unused, and free from defect.
- B. Fabricator shall be an AISC MB Category, Metal Building Systems Certified Fabricator.

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- C. Erection and installation of work covered by this Section shall be performed by building manufacturer's personnel or by subcontractors Certified by the building manufacturer for erection and installation of manufacturer's products. Subcontractor shall be thoroughly familiar with manufacturer's product, having a minimum of five (5) years experience installing projects of this nature. Erection work shall be under direction and supervision of an experienced supervisor employed by manufacturer of the Certified subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Upon arrival at job site, sheets and panels shall be inspected for moisture accumulation. If found wet, remove moisture, re-stack, and protect sheets and panels until used.
- B. Store metal sheets or panels to allow water which has accumulated during transit or storage to drain. Do not store sheets and panels in contact with materials which cause staining.
- C. Deliver, store, and handle prefabricated components, sheets, panels, and other manufactured items in such a manner that they will not be damaged or deformed. Stack materials stored on site on platforms or pallets and cover with tarpaulins or other suitable vented weathertight covering.

1.7 WARRANTY

- A. Roof and Wall Panels: Provide 20 year weather tightness warranty, by building manufacturer, covering durability of roof and wall panels due to rupture, structural failure, or perforation.
- B. Roof and Wall Panel Finish (exterior color bake-on): Provide 20 year warranty, by building manufacturer, covering panel finish against blistering, peeling, cracking, flaking, checking, chipping, and excessive color change and chalking. Color change shall not exceed 9 N.B.S. units for roof panels and 5 N.B.S. units for wall panels, (per ASTM D2244.64T) and chalking for wall panels shall not be less than a rating of 8 per ASTM D659-86.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot Rolled Structural Shapes: ASTM A36 or ASTM A529 with 36 ksi or 50 ksi minimum yield stress.
- B. Tubing or Pipe: ASTM A500, Grade B; ASTM A501; or ASTM A53, Type E, Grade B.
- C. Plate or Bar Stock: 42,000 PSI minimum yield strength: ASTM A529, ASTM A570, or ASTM A572.
- D. Cold-Formed Steel: ASTM A607, Grade 50 minimum.
- E. Galvanized Steel Sheet: ASTM A446, G90 coating, or ASTM A525, G90.
- F. Bolts for Framing: ASTM A307 or ASTM A325.
- G. Primer Paint: Manufacturer's standard gray and shall conform to Steel Structure Painting Council Specifications TT-P-636.

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2.2 MANUFACTURERS

- A. Roofing panels shall match MBCI, Ultra-Dek, 24 gauge
- B. Wall panels shall match MBCI, “U” panel, 24 gauge
- C. Soffit and liner panels shall match MBCI Artisan L12 with beads 26 gauge.

2.3 ROOF PANEL MATERIAL

- A. Galvalume sheet conforming to the requirements of ASTM A792 with an AZ55 coating.

2.4 WALL AND SOFFIT PANEL MATERIAL

- A. Structural Quality Galvanized Steel Sheet: Hot-dip zinc-coated steel sheet complying with ASTM A 446 with G90 coating complying with ASTM A525, Grade C or to suit manufacturer's standards. Provide sheet material matching formed panel finishes for building trim and closures.

2.5 METAL FINISHES

- A. General: Apply coating either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating by application of strippable film to properly protect finish. Furnish air-drying spray finish in matching color for touch-up.
 - 1. Color shall be as indicated from manufacturer's color selections, both standard and custom. Provide minimum sixteen (16) colors.
- B. Fluoropolymer Coating: Manufacturer's standard two coat, thermocured, full strength 70 percent “Lynar 500” coating consisting of a primer and a minimum 0.75mil dry mil thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with STM D 523.
 - 1. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of NO. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.

2.6 INSULATION:

- A. Roof: Two layers (6 inches total) R-13 with white foil scrim facing on bottom layer only.
 - 1. Scrim facing on insulation that is exposed in the finished building shall be heavy, abuse resilient type. At other locations, scrim facing may be manufacturer's standard product.
 - 2. Roof insulation shall be flexible, noncombustible fiberglass blankets with vapor resistant membrane. Vapor resistant membrane shall be laminated to insulation as composite unit. Insulation and vapor membrane shall carry Underwriters Laboratories Inc. (U.L. label) fire hazard classification indicating flame spread rating of 25 or less and a smoke developed rating of 450 or less, as a tested assembly.

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3. Insulation system shall be applied under exposed metal roofing panels and over the roof support member. Vapor membrane shall always be placed to interior of building, whether it be exposed or nonexposed. Joints shall be lapped, taped, or folded, and stapled in accordance with building manufacturer's standard. Vapor membrane shall have a perm rating of not more than 0.02.
 4. With R-13 blanket-type insulation only, thermal spacer (block) shall separate roof support member from roof panel, except at each concealed structural fastener. Spacer shall be of material having density of not less than 2 pcf and, if combustible material, shall be classified as having flame spread rating not greater than 25 when tested in accordance with ASTM E84-84.
- B. Walls: One layer (4 inches total) R-13 with white foil scrim facing on inside only, manufacturer's standard product.
1. Wall insulation shall be flexible, noncombustible fiberglass blankets with vapor resistant membrane. Vapor resistant membrane shall be laminated to insulation as composite unit. Insulation and vapor membrane shall carry Underwriters Laboratories Inc. (U.L. label) fire hazard classification indicating flame spread rating of 25 or less and a smoke developed rating of 450 or less, as a tested assembly.
 2. Insulation system shall be applied under exposed metal wall panels and over the wall support member. Vapor membrane shall always be placed to interior of building, whether it be exposed or nonexposed. Joints shall be lapped, taped, or folded, and stapled in accordance with building manufacturer's standard. Vapor membrane shall have a perm rating of not more than 0.02.

2.7 GUTTERS AND DOWNSPOUTS

- A. Gutters: Gutters shall be provided complete with mitered corners, end pieces, and special pieces that may be required. Gutters shall be formed in sections not less than eight feet in length. Ends of each length shall be joined with riveted and sealed joints, except that expansion-type slip joints shall be provided at center of runs, unless specified otherwise. Gutters shall be supported on hangers of approved type, spaced at 36" o.c. maximum. Hangers and fastenings shall be constructed of metal compatible with gutters.
- B. Downspouts: Provide shapes and sizes as indicated on drawings, complete including elbows and offsets. Downspouts shall be provided in approximate 10' lengths; end joints shall telescope not less than 1-1/2", and longitudinal joints shall be locked. Gutter outlets shall be provided with zinc-coated steel, stainless steel, or nonferrous metal wire ball strainers of standard type. Downspouts shall be kept not less than 1" away from walls, and shall be fastened to walls to top, bottom, and at maximum 5' centers intermediately between, with leader straps, or concealed type fasteners; straps and fasteners shall be formed from metal compatible with the downspouts.

2.8 ACCESSORIES

- A. Fasteners for Securing Panels:
1. Fasteners for roof panels shall be 20 year fasteners.

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2. Fastening system shall be designed to withstand design loads specified herein.

B. Sheet Metal Accessories:

1. Zinc-coated steel accessories shall be provided with zinc-coated siding or roofing, and aluminum accessories shall be provided with aluminum alloy siding or roofing. Zinc-coating for all sheet steel accessories, including continuous ridge vents, and louvers shall conform to 1.25 oz. PSF coating class.
2. Caps, Strips, and Plates:
 - a) Ridge caps, eave and edge strips, fascia strips, miscellaneous flashings, and miscellaneous sheet metal accessories, unless specified otherwise, shall be formed from the same materials and gauge as roof covering.
 - b) Wall plates, base angles or base channels, and other miscellaneous framing members may be standard structural steel shapes, or may be formed from steel not lighter than 16 gauge.
3. Roof Jacks and Curbs
 - a) Openings 8" or smaller may be flashed and sealed to roof panel by jacks, providing complete structural support and weathertightness are maintained. Material shall be either metal with protective metallic coating or EPDM material with aluminum sealing ring base.
 - b) Openings larger than 8", round or square, shall be framed with welded metal base fabricated from 0.07" thick (minimum) galvanized steel. Base and related appurtenance shall be supported by roof purlins and header framing. Base shall have minimum projection of 8" above weather surface of roof, and configuration of flanges shall match roof panel. Flange-to-panel joint shall be sealed with non-hardening sealant and fastened in manner to provide complete support and weathertightness.
4. Miscellaneous Accessories:
 - a) Closure Strips: Formed of approved solid synthetic or natural rubber, or other material, standard with manufacturer of system furnished. Molded closure strips shall be free of opened voids and shall not absorb or retain water. Closure end strips shall be formed to match the corrugations or configurations of the roofing or siding being used and shall be provided where indicated and elsewhere to provide weathertight construction. Sealing material shall be used also for sealing joints in and around sealing strips at ridges, eaves, valleys, bottom course in siding on vertical surfaces, bolt holes before inserting fasteners, for flashings and corner closure sheets, and elsewhere to provide watertight construction. Bituminous type sealing materials shall not be used with factory color coated or painted sheets and panels.
 - b) Joint Sealing Material: Type as recommended by roofing and siding manufacturer to seal side and end laps in metal roofing of deep corrugation type where slope of roof is less than 3 in 12". Material shall be applied in accordance with manufacturer's printed instructions of material furnished. sealing material shall

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be used also for sealing joints in and around sealing strips at ridges, eaves, valleys, bottom course in siding on vertical surfaces, bolt holes before inserting fasteners, for flashing and corner closure sheets, and elsewhere to provide watertight construction. Bituminous type sealing materials shall not be used with factory color coated or painted sheet or panels.

2.9 FABRICATION

- A. Structural steel members shall be sheared, formed punched, welded and painted in plant of manufacturer.
- B. Welding shall be in accordance with standard practices of the American Welding Society, and shall be performed by qualified welders.
- C. Clearly and legible mark each piece and part of assembly to correspond with previously prepared erection drawings, diagrams and instruction manuals.
- D. Surface preparation shall conform to requirements of Steel Structures Painting Council Specification SSPC-SP3.
- E. Paint shall conform to requirements of Steel Structures Painting Council Specification TT-P-636.
- F. Dissimilar Materials:
 - 1. Where aluminum surfaces come in contact with ferrous metal or other incompatible metals, the aluminum surfaces shall be kept from direct contact by one of the following methods:
 - a) Paint incompatible metal with coating of heavy-bodied bituminous paint.
 - b) Paint incompatible metal with prime coat of zinc-chromate primer followed by one or two coats of aluminum metal-and-masonry paint, or other protective coating, excluding those containing lead pigmentation.
 - c) Nonabsorptive gasket.
 - d) Caulk between aluminum and incompatible metal.
 - 2. If drainage from incompatible metal passes over aluminum, incompatible metal shall be painted by Method "a" or Method "b" above. Aluminum surfaces in contact with concrete or masonry materials shall be painted by Method "a". Green or wet wood, or wood treated with preservative, shall be painted by Method "a" or shall be given two coats of aluminum paint.
- G. Finish:
 - 1. Roof Panels: Galvalume or aluminized steel.
 - 2. Wall and Other Panels: Kynar 500 fluoropolymer coating with minimum 70% resins; manufacturers standard sand color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer shall examine substrate and conditions under which work is to be installed. Notify Contractor in writing of any conditions detrimental in installation of work. do not proceed with work until unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Framing Members: Plumb in both directions, guy and stay and space framing elements to assure proper fitting of prefabricated wall and roof coverings.
- B. Wall and Roof Panels:
 - 1. Wall Construction: Panels shall be applied with corrugations, ribs, or other configurations in vertical position. Panels shall be supplied in full wall height from base to eave with no horizontal joints except at junctions of door frames, window frames, louver panels, and similar locations. Side and end laps shall be sealed with joint sealing materials specified herein. Walls shall be flashed and sealed at base, at top, around windows, doors, framed louvers, and other similar openings. Placement of closure strips, flashing and sealing materials shall be accomplished in manner which will assure complete weathertightness. Flashing will not be required where approved "self-flashing" sheet or panels are used. Minimum end laps for panels shall be 2-1/2". Minimum side laps for panels shall be one corrugation or one configuration. side and end laps shall be sealed as specified herein for roofing, except that only one bead of plastic cement shall be required.
 - 2. Roof Construction: Roof slope shall be as indicated. Roofing panels shall be applied with corrugations, ribs, or other configurations parallel to slope of the roof. Roofing panels shall be supplied in longest lengths obtainable with end laps occurring only at structural members. Side laps shall be laid away from prevailing wind. Side and end laps shall be sealed with joint sealing material specified herein. Flash and seal roof at ridge, eaves, rakes, and projections through roof, and elsewhere to assure weathertight construction. Placement of closure strips, flashing, and sealing material shall be accomplished in an approved manner which will assure weathertightness. Contact surfaces between roofing sheets at end and side laps shall be sealed with plastic cement, squeezed from pressure gun and forming two beads, each not less than 1/4" thick or building manufacturer's standard application.
 - 3. Liner Panels: Where liner panels are installed in inmate areas (dayrooms and exercise) all edges shall be protected with a 18 ga angle connected to wall or abutted structure with tamper resistant screws. All connectors visible in finished job shall be tamper resistant.
- C. Defects: Defects or errors in fabrication of building components shall be corrected by Contractor in a manner approved by the Architect. Defects or errors in fabrication of components, which cannot be corrected in an approved manner, shall be replaced by nondefective members at no additional cost to the Owner.

3.3 TOLERANCES

- A. Framing Members: AISC Code of Standard Practice and Commentary and MBMA Code of Standard Practice and Commentary, latest editions.

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SECTION 134263 – PREFABRICATED PRECAST CONCRETE CELL MODULES
(FOR REFERENCE ONLY)

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. Prefabricated precast concrete cell module.
- B. Related Requirements:
 - 1. Division 03 Section “Cast-in-Place Concrete” for slab-on-grade closure strip and general concrete construction.
 - 2. Division 04 Section “Unit Masonry Assemblies” for full-size brick facing, mortar, and anchorages.
 - 3. Division 07 Section “Sheet Metal Flashing and Trim” for flashing receivers and reglets.
 - 4. Division 07 Section “Joint Sealants” for elastomeric joint sealants and sealant backings.

1.3 PERFORMANCE REQUIREMENTS

- A. Engineer and fabricate precast concrete cell modules, provide materials and products complying with pertinent requirements of current edition of the Building Codes and reference standards.
- B. Building Codes and Regulatory Requirements:
 - 1. International Building Code – ICC
 - 2. International Mechanical Code – ICC
 - 3. International Plumbing Code – ICC
 - 4. National Electric Code – NFPA
 - 5. Standard Building Code – SBCCI
 - 6. Uniform Building Code – ICBO
 - 7. National Building Code – BOCA
- C. Reference Standards:
 - 1. Concrete:
 - a. American Concrete Institute (ACI):
 - 1) ACI 211.1 - Standard Practice for Selecting Proportions for Normal,

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- Heavyweight, and Mass Concrete.
 - 2) ACI 301 - Specifications for Structural Concrete for Buildings.
 - 3) ACI 318 - Building Code Requirements for Structural Concrete.
 - b. Concrete Reinforcing Steel Institute (CRSI) - CRSI Manual of Standard Practice.
 - c. Wire Reinforcement Institute (WRI) - WRI Manual of Standard Practice.
 - d. Precast/ Prestressed Concrete Institute (PCI)
 - 1) MNL-116- Manual for Quality Control: Structural Precast Concrete.
 - 2) MNL-124- Design for fire resistance of precast, prestressed concrete.
2. Welding:
- a. American Welding Society (AWS):
 - 1) AWS D1.1 - Structural Welding Code - Steel
 - 2) AWS D1.4 - Structural Welding Code - Reinforcing Steel
- D. Design Requirements: Comply with building codes and ACI 318. Structurally connect each cell module to the foundation and cell module to cell module vertically.
- 1. Floor Live Load: 40 pounds per square foot (psf) in cells and 100 psf for balconies.
 - 2. Wind Load per building code.
 - 3. Top of Upper Cell: 40 pounds per square foot.
 - 4. Seismic Load per building code.
 - 5. Cell Furniture Attachments, Embeds, and Inserts: Provide structural design and loading criteria for inmate cell furniture/furnishings. Engineer and design attachments.
 - 6. Provide six-sided construction with integral walls, floor and ceiling. The exterior wythe shall be cast horizontally to achieve a uniform architectural finish per the project plans and specification. Provide a concrete chase floor with openings for mechanical, electrical and plumbing risers. Any required firesafing shall be furnished and installed by other trades.
 - 7. Maximum Allowable Deflection: As limited by governing building code for all structural elements and the requirements of the design.
 - 8. Interface design of units with furnishings, structural, mechanical, plumbing and electrical systems, and components shown or indicated to interface with cell modules.
 - 9. Accommodate system for construction tolerance, deflection of other building structural members and clearances of intended openings.
 - 10. Stair load on balcony not to exceed 2.0 kips at each stringer, total load not to exceed 4.0 kips. Angle of stair stringer with floor must be greater than or equal to 30 degrees. These loads apply to balconies up to 5'-0" in width.
- E. Fire Ratings: Refer to guidelines contained in PCI MNL-124 to achieve required fire ratings for floors, walls and roof assemblies as follows:
- 1. Structural fire endurance exceeds 4 hours
 - 2. Heat transmission fire rating:
 - a. Load bearing exterior wall: 4 hours
 - b. Non-load bearing partition walls: 2 hours

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- c. Load bearing interior walls: 3 hours
- d. Floor and ceiling at mezzanine: 2 hours
- e. Ceiling at roof level: 2 hours

- F. Design the precast concrete cell modules to provide lateral stability for the housing units and the cells.

1.4 REFERENCES

A. American Concrete Institute (ACI):

- 1. ACI 301 - Specifications for Structural Concrete for Buildings.
- 2. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM):

- 1. ASTM A 36 - Specification for Structural Steel
- 2. ASTM A 74 - Specification for Cast Iron Soil Pipe
- 3. ASTM A 82 - Specification for Steel Wire, Plain, for Concrete Reinforcement.
- 4. ASTM A 153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- 5. ASTM A 185 - Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
- 6. ASTM A 307 - Specification for Carbon Steel Bolts and Studs
- 7. ASTM A 416 - Standard Specifications for Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete
- 8. ASTM A 615 - Specification for Deformed and Plain Concrete Reinforcement
- 9. ASTM A 706 - Specification for Deformed and Plain Wire for Concrete Reinforcement
- 10. ASTM B 88 - Specification for Seamless Copper Water Tube for Plumbing Applications
- 11. ASTM C 33 - Specification for Concrete Aggregates.
- 12. ASTM C 330 - Specification for Lightweight Aggregates
- 13. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- 14. ASTM C 94 - Specification for Ready-Mixed Concrete.
- 15. ASTM C 150 - Specification for Portland Cement.
- 16. ASTM C 172 - Practice for Sampling Freshly Mixed Concrete.
- 17. ASTM C 231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- 18. ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete.
- 19. ASTM C 494 - Specification for Chemical Admixtures for Concrete.
- 20. ASTM C 578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
- 21. ASTM C 1289 - Specification for Preformed, Cellular Isocyanurate Thermal Insulation
- 22. ASTM C 1107 - Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).

C. American Welding Society (AWS):

- 1. AWS D1.1 - Structural Welding Code - Steel
- 2. AWS D1.4 - Structural Welding Code - Reinforcing Steel

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- D. Concrete Reinforcing Steel Institute (CRSI): CRSI Manual of Standard Practice
- E. National Electrical Manufacturers Association (NEMA):
- F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- G. National Fire Protection Association (NFPA):
 - 1. NFPA 70 - National Electric Code
 - 2. NFPA - Life Safety Code
- H. Precast Concrete Institute
 - 1. PCI MNL 116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
 - 2. PCI MNL 120 - Design Handbook: Precast and Prestressed Concrete.
 - 3. PCI MNL 123 - Manual on Design of Connections for Precast and Prestressed Concrete Products.
 - 4. PCI MNL 124 - PCI Design for Fire Resistance of Precast Prestressed Concrete.
 - 5. PCI MNL 127 - Recommended Practice for Erection of Precast Concrete
- I. Steel Structures Painting Council (SSPC):
 - 1. SSPC- SP7 - Brush-Off Blast Cleaning
- J. Underwriters Laboratories (UL), Inc.
 - 1. UL Standard 83 for THHN insulated copper wire
 - 2. UL Standard 514A for metallic outlet boxes

1.5 SUBMITTALS

- A. Product Data: Manufacturer's original catalog cut sheets, published specifications and material description for each sub-component incorporated into the precast cell module.
- B. Shop Drawings: Submit concept drawings before award of bid and submit shop drawings after award. Drawings to include, cell module upfit plans, elevations, sections and dimensioned layouts.
 - 1. Include details of joints, reinforcement, anchors, inserts, embedded and cast-in-place items, lifting devices.
 - 2. Connection details for mechanical, plumbing, electrical system components, HVAC and cell furnishings including embedments and attachment devices.
- C. Erection drawings: Submit concept drawings before award of bid and submit erection drawings after award. Drawings to include the following:
 - 1. Module bearing plan, floor plans and elevations.
 - 2. Cell module upfit plans, elevations, sections, architectural exterior wall design and

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- dimensioned layouts.
 - 3. Include details of joints, reinforcement, anchors, inserts, embedded and cast-in-place items, lifting devices.
 - 4. Connection details for mechanical, plumbing, electrical system components, HVAC and cell furnishings including embedments and attachment devices.
 - 5. Provide complete erection notes.
 - 6. Show lifting, setting, cell to cell and cell to foundation connections, and structural grout.
 - 7. Show proper module site storage dunnage and procedures.
- D. Cell Module Structural Calculations: Submit cell module structural design calculations. Calculation shall be prepared, signed, and sealed by a Structural Engineer registered in the state where the module has been manufactured.
- E. Sample Control: Submit exterior architectural wall finish samples (if applicable):
- 1. Provide 1'-0" x 1'-0" sample sizes for approval of each texture and color only.
 - 2. Provide a minimum size of 4'-0" x 4'-0" for approval for use as a mock-up for each specific color/texture. Keep one set of mock-ups at plant for control, provide one set of mock-ups for use at the jobsite as a standard for acceptance. Maintain jobsite mock-ups in similar exposure conditions to the completed cell modules. Removal of the mock-up sample from site is by others.
- F. Quality Control documentation shall be available from manufacturer's plant records:
- 1. Concrete mix design
 - 2. Control Test Reports
 - a. Pre-pour and post-pour inspections
 - b. Mechanical, electrical and plumbing inspections
 - c. Paint and coatings inspections
 - d. Final inspections
 - 3. Certifications:
 - a. PCI Plant Certification
 - b. Modules are manufactured under the supervision of a Professional Engineer registered in the state manufactured.
- 1.6 QUALITY ASSURANCE
- A. General: Module manufacturer shall perform work in compliance with the applicable requirements and PCI MNL 116.
- B. Cell module manufacturer's Sole Responsibility is to provide the prefabricated precast concrete cell modules in conformance to this specification.
- C. Qualifications:
- 1. Fabricator: Plant of manufacturer shall be certified by the Precast/Prestressed Concrete

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Institute (PCI) annually for production group and category C1 for a period of five or more years. The fabricator shall show that it has been manufacturing the work of this Section with a minimum of three years documented precast cell module experience and five or more successfully completed projects of similar size, magnitude and specific scope as this project.

2. Quality Control System: Provide a complete quality control system that includes design controls, process controls, materials and vendor controls, complete record keeping and audit trails, distinct inspection marks, and 100% inspection of all mechanical, electrical, plumbing, structural systems and coatings. All plumbing and electrical systems shall be tested in the manufacturing facility.
3. Installer: The erector shall have erected projects utilizing the work of this Section with a minimum of five years documented experience or the module manufacturer must provide an on site supervisor.
4. Professional Engineer: Structural Engineer, licensed to practice in the state of fabrication and experienced in design and fabrication of precast concrete modular construction, under whose supervision the precast concrete components and structural anchorages are designed and manufactured.
5. Project Management: Fabricator and erector shall have a documented Project Management System, which describes the project execution process. This system shall have been in place for at least five (5) years and implemented on all projects of similar size and nature during that period. Fabricator and erector shall have a single Project Manager identified for this project who will oversee project execution from the point of contract execution to final completion.

D. Tolerances:

1. Cell Modules to meet tolerances recommended in PCI Manual 116 pages B50 & B51, "Modular Unit" and the following manufacturing tolerances (not to be confused with erection tolerances in SS 3.3)
 - a. Length or width: $\pm \frac{1}{8}$ " in 10', $\frac{1}{4}$ " total
 - b. Out of square: $\pm \frac{1}{8}$ " in 10', $\frac{1}{2}$ " total
 - c. Bow or warp: $\frac{1}{2}$ " total
 - d. Floor flatness: $\pm \frac{1}{8}$ " in 10', $\frac{1}{4}$ " total
 - e. Joint between wall and floor: $\pm \frac{1}{8}$ ", $\frac{1}{4}$ " total in module
 - f. Wythe thickness: $\pm \frac{1}{4}$ " from design width
 - g. Insulation positioning: $\pm \frac{1}{4}$ " from true position
 - h. Reinforcement positioning: $\pm \frac{1}{4}$ " from true position
 - i. Opening / fixture location: $\pm \frac{1}{4}$ " from true position
 - j. Out of plumb/level: $\pm \frac{1}{8}$ " across fixture length/width
 - k. Chase plumbing alignment: $\pm \frac{1}{4}$ " from design position
2. Security Doors to meet the requirements of the Hollow Metal Manufacturer's Association Manual 863-90 Detention Doors and Frames and the following tolerances:
 - a. Frame Squareness $\pm \frac{1}{16}$ " jamb to jamb at the head
 - b. Frame Plumb $\pm \frac{1}{16}$ " jamb from head to floor
 - c. Door to frame clearance will be $\frac{1}{8}$ " installed to $\pm \frac{1}{16}$ ". Door may not drag.
 - d. Slider frame straightness $\pm \frac{1}{8}$ " jamb from head to floor

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3. Fabricated Steel items shall be build to $\pm 1/8$ " and installed $\pm 1/4$ " from true position.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Module manufacturer to provide transportation and delivery of cell module units to the job site.
 1. Deliver cell modules and chase complete with all components.
 2. Module manufacturer shall not be responsible for site storage or protection.
 3. Identification: Mark each unit prior to delivery with a unique serial number indexed to the manufacturer's quality control records.
- B. Handling: Handle precast cell module units in a manner consistent with their shape and design to ensure protection from damage during handling.
 1. Lift and support cell module units only from engineered support and lifting points.
 2. Provide lifting and handling devices capable of supporting units in positions during storage, transportation, and erection.

1.8 ACCEPTANCE

- A. Cell modules shall be thoroughly tested & inspected prior to shipping and contain no known defects in materials, products, equipment, or conditions of careless or unskilled workmanship.
 1. Precast components shall conform to the requirements of PCI manual 116.
 2. Modules shall be properly finished according to the requirements of this specification.
 3. Mechanical and electrical components, equipment, devices and component devices, provided as a part of a cell module unit, shall be functional and operate with care and attention under conditions of application specified by their manufacturer.
 4. Security detention components, equipment and devices, provided as a part of a cell module unit, shall be functional and operate with care and attention under conditions of application specified by their manufacturer.
- B. Modules accepted for erection by others shall be accepted as follows.
 1. Visible defects shall be noted on the bill of lading upon arrival of a module. Signing the bill of lading constitutes acceptance, subject to any visible defects noted on the bill of lading.
 2. The owner shall notify the manufacturer in writing of any hidden defects within 24 hours of their discovery.
 3. Defects and claims shall be reported in writing and in no case after the period of erection ends.
- C. Modules accepted after erection service provided by manufacturer shall be accepted as follows.
 1. A walk through inspection shall be conducted within 30 days of the completion of erection.
 2. Modules shall be considered accepted when all deficiencies noted in the inspection have

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- been corrected.
- 3. Hidden defects shall be subject to Manufacturer's certificate of limited warranty
- D. No other representations of merchantability or fitness for a particular purpose, express or implied, are made except as provided herein or agreed in writing. Manufacturer's obligations shall be limited to repair or replacement of defects under this specification and shall not include consequential reparations.
- E. A certificate of limited warranty shall be furnished upon acceptance.

1.9 WARRANTY

- A. Cell Module Warranty: Module manufacturer shall provide a certificate of limited warranty, commencing on the date of acceptance and accruing for one year past the date of Substantial Completion or the date of the certificate of occupancy which ever comes first.
- B. Component Product and Equipment Warranties: Copies of manufacturer's product and equipment warranties to be included in the module manufacturer's certificate of limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Tindall Corportation
 - 2. Or equal as approved by Architect.

2.2 GENERAL

- A. Provide factory fabricated and assembled cell modules requiring only field placement and connections for use. Fabrication shall be in compliance with applicable requirements and reference standards. Provide complete shop fabrication and finishing for precast concrete cell modules to include the following:
 - 1. Interior surface finishes and coatings.
 - 2. Exterior architectural concrete wall finish on cell modules (if applicable, architectural finish may include color, texture, reveals and/or in-laid brick veneer).
 - 3. Hollow metal cell door frames substantially filled with concrete.
 - 4. Hollow metal cell doors and hinges.
 - 5. Electrical conduit and junction boxes for cell light fixture and associated wiring for connection to field wiring.
 - 6. Detention furnishings, equipment and accessories including wall mounted writing surface, stool, bunk, mirror, shelf with hooks, embeds, inserts, security fasteners and

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- security bolts. All connections to be bolted with exception to handicapped desk and grab bar which are attached with ¼” x 1 ½” mushroom head stainless steel spike.
7. Water piping and waste plumbing from combination lavatory/toilet to the cast iron wye connection. Modules require field connection from utility chase to utility chase and utility chase to underground or plenum plumbing.
 8. Plumbing fixtures/valves, hydraulically activated flush valve with overflow preventer at the toilet. Pneumatic dual temperature metering valve at the lavatory.
 9. Chase supply and exhaust ductwork as shown on standard module drawings. Modules require field connection from utility chase to utility chase and utility chase to base or plenum ductwork.
 10. Security air distribution grilles.
 11. Cell door glazing.
 12. Cell light fixture.

2.3 CONCRETE MATERIALS AND ACCESSORIES

- A. Portland Cement Concrete: 5000 PSI at 28 days, 1 to 3 inch slump prior to addition of plasticizers, proportioned and mixed in a mixer located on the plant site of manufacturer, with the following additional requirements. Transit mixed concrete is unacceptable.
 1. Portland Cement: ASTM C 150
 2. Fine Aggregate: ASTM C 33 or ASTM C 330
 3. Coarse Aggregate: ASTM C 33 or ASTM C 330
 4. Water: Potable
 5. Water/Cementitious Material Ratio: Maximum 0.45 by weight
- B. Concrete Admixtures: Chloride free
 1. Less than 0.1 percent chloride ions by weight in the admixture.
 2. Water Reducing Agent: High range, conforming to ASTM C 494.
 3. Reinforcing Steel: ASTM A 615 or A706, Grade 60, deformed bars and welded steel wire fabric for concrete reinforcement; ASTM A 185 for wire mesh.
- C. Strand: Strands shall comply with ASTM A 416 as required by design.
- D. Cement Grout: Sand and Portland cement mixed in proportions for design of supported loads.
- E. Bearing Pads: Material type and thickness to be determined by design.
- F. Non-shrink grout: ASTM C 1107, factory pre-mixed, non-metallic.

2.4 CONCRETE EMBEDMENTS

- A. Cast-in Anchors:
 1. Embedments for Connection and Supporting Devices: ASTM A 36, carbon steel plates, angles, items cast into concrete, items connecting steel framing members and inserts, conforming to PCI MNL-123; unpainted if not exposed to weather or view, otherwise

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2. painted to reduce the occurrence of rust.
2. Bolts: ASTM A 307.

B. Concrete Inserts:

1. Lifting Inserts: Integrally cast; design for lifting and erection capacity.
2. Threaded Inserts: Suitable for mounting detention equipment accessories with threaded security fasteners.

C. Steel Tie Wire: ASTM A 82, annealed, steel, galvanized.

2.5 FABRICATION ACCESSORIES

A. General: Fabricate precast concrete cell modules in accordance with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, as specified for types of units required.

B. Welding Electrodes: AWS D1.1

C. Security caulk: Provide security sealant in all interior joints and around all attachments to cell walls. The caulk shall have a Shore A hardness of 55 (+/- 5). Pecora Dynaflex SC or equal.

D. Detention Doors and Frames: Provide product shown below:

1. Cell Front Wall Door frame (for swing door): Frames shall be one piece 12 gauge galvanealed steel construction to receive detention hollow metal door. Frames shall be prepared for jamb-mounted locks (Southern Steel 10120A, Folger Adams 122, RR Brink A5022, or Airteq 9700-1, by others) and a door position switch (Southern Steel 240, switch is by others). Jambs shall be prepared for locks keyed 1 side only and (3) 4 1/2" security hinges, Portland or equivalent. Necessary electrical conduit and lock pockets shall be integral to the frame completely sealed from grout leakage and routed through the concrete to the utility chase. By Slate or equivalent.
2. Cell Front Wall Door frame (for sliding door):
3. Cell Front Wall Swing Doors: Doors shall be of detention hollow metal construction with minimum 12 gauge galvanealed steel. Door shall have a 20" x 34" security glazing vision light of 13/16" clear glass clad polycarbonate, flush pull inside and loop pull outside. Doors shall include (3) 4 1/2" security hinges. Slate or equivalent.

E. Detention Furnishings, Equipment and Accessories: provide and coordinate installation:

1. Shelf with Garment Hooks: Shelf shall be 8" x 18" with (4) stainless steel safety type hooks. Shelf shall have folded and welded seamless edges. Construction to be 10 gauge steel with uncream color powder coat finish. Back plate to be punched for through wall security bolt connection (fastened to unit in adjoining cell). By Chief or equivalent.
2. Detention Mirror: Mirror and frame shall be 12 1/2" x 16 1/2". Mirror shall be provided with wall embedded mounting plate. Construction shall be of minimum 20 gauge stainless steel plate with a highly polished surface and 16 gauge chrome frame, fastened with security fasteners. Handicap mirror and frame shall be 12 1/2" x 31".
3. Bunk: Bunk shall be a wall-mounted 27" x 82" pan type bunk with folded and welded

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- seamless edges. Construction shall be of minimum 10 gauge steel with unicream color powder coat finish. By Chief or equivalent.
4. Desk: Desk shall be a wall mounted 2'-0" x 1'-6" pan type desk with folded and welded seamless edges. Desk shall be provided with heavy 3/16" flanged brackets for attachment to the wall utilizing a through wall security bolt connection (fastened to unit in adjoining cell). Construction shall be of minimum 10 gauge material with powder coat finish. By Chief or equivalent.
 5. Stool: Stool shall be wall mounted with a 12" diameter stool type seat. Seat shall be of minimum 16 gauge stainless steel with 1/8" steel reinforcement and supported by cantilevered pipe and plate construction. Back plate to be punched for through wall security bolt connection (fastened to unit in adjoining cell).
 6. Handicap Desk: Desk shall be floor mounted with a removable 12 gauge swing out stool for wheelchair access. The writing surface shall be 36" wide, 20" deep and 31½" above finish floor (30" clear height). Construction shall be of minimum 10 gauge steel and finish to be unicream color powder coated. The desk shall be security fastened to the floor.
 7. Security Fasteners: Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 111993. Finish shall match that specified of the item anchored.

F. Mechanical: Provide and coordinate installation of product shown below:

1. HVAC Supply and Exhaust: Supply and exhaust ductwork shall be 22 gauge galvanized with sealed Pittsburgh Lock corner construction. The ductwork shall be securely fastened to the module, caulked to be airtight. Exhaust ductwork is prepped for 6" dia. connections from module to module and module to site exhaust to be provided and installed by others. Each cell has independent exhaust ducts to allow for volume control and cell smoke detection (by others if required). Supply duct transition pieces shall contain a baffle to restrict pass through and communication between adjacent cells and shall have closed cell insulation on surfaces exposed to the chase to retard condensation and to prevent potential water damage. Supply ductwork is prepped for 10" dia. connections from module to module and module to site supply to be provided, installed and balanced by others. A single supply duct connection can supply up to four cells (two utility chases). Supply and exhaust duct work does not include access doors.
2. Security Diffusers: Two security HVAC grilles shall be provided between the cell and utility chase. Each grille shall be cast in place and construction shall consist of a minimum 3/16" material with a perforated plate on the cell side having 5/16" holes on 7/16" centers (to create a 6" x 10" perforated opening). Supply grille shall have a volume control damper with mechanical adjustment.

G. Electrical: Provide and coordinate installation of product shown below:

1. Cells shall be complete with a factory wired and factory tested electrical system including a cell light and night light. Each cell shall have a cast in intercom/call box to allow for field addition of security systems, intercom, call button, cell light switch, receptacle, etc. Power wiring, 120 volt, shall terminate in the chase with color coded wiring in a junction box for connection to field wiring. Provide 12 gauge THHN insulated copper wire. See Alternate Bid #4 for intercoms.
2. Conduit and Junction Boxes: All conduit and junction boxes shall be cast into concrete walls and ceilings or face mounted in the utility chase. All junction boxes shall be

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- stamped steel concrete-tight single or multi-gang boxes as indicated and meet UL Standard 514A for metallic junction boxes.
3. Utility Chase Electrical Junction Box: There shall be a junction box in the chase for cell 120-volt power to be connected by others.
 4. Utility Chase Detention Equipment Junction Box: There shall be a junction box in the chase providing for field installation of security locks, signals, etc. Individual cast in place $\frac{3}{4}$ " conduits shall connect each doorframe lock pocket to the junction box in the chase. These occur only with swing doors.
 5. Cell Intercom/Call Box: There shall be a cast in triple gang box with a $\frac{3}{4}$ " nipple to the utility chase for connection by others if intercom, call button, light switch or receptacle is to be utilized (by others). See Alternate Bid #4 for intercoms.
 6. Security Light Fixture: Light fixture shall be a 1'-0" x 4'-0" ceiling mounted fluorescent light fixture with night light. Housing shall be (1) piece die formed 14 gauge stainless steel with corners continuously seam welded and smooth for a single piece clamshell type barrier. The baseplate shall include a die-formed blade trap (min. of $\frac{1}{4}$ " in depth) to prevent the concealment of contraband. Hinge to be a completely concealed internal heavy gauge drop-slot stainless steel piano type with $\frac{1}{8}$ " diameter pin. Ballast shall be supplied for single circuit application with F32T8 lamps. Lens shall be .125" prismatic acrylic and .250" clear polycarbonate. Lens retention shall be continuous Z-channel brackets mounted to through-studs spaced at 6" (max) intervals. Fixture to be mounted using hardened security screws recessed to prevent gripping or prying. Fixture shall have a factory applied Aliphatic Urethane powder coating over a (5) stage iron phosphate pre-treatment. Reflectance: 92%. Gloss: 85%(Min) at 60 degrees. 2H salt spray: 500 hours. Kenall SSA Series or equivalent.

H. Plumbing: Provide and Install products shown below.

1. Plumbing shall be as follows. Hot and cold water pressure plumbing shall be copper tube conforming to ASTM B 88. Manufacturer shall provide and install a cast iron wye fitting for plumbing waste and provide a 4" pinned clean out for each water closet. All copper pipe joints shall be soldered. Hot water shall be insulated with closed cell Armaflex insulation or equal. Hook up to building main supply water shall be by others per the project specification. All supply lines shall be completely flushed to eliminate all debris in the lines before making connections to cell modules and before using any valves (valves are sensitive to debris). All cell module bubblers and valves to be adjusted by site contractors. The water pressure must not exceed 100 PSIG static to avoid valve damage and the water pressure must maintain over 25 PSIG during flush for proper operation. Floor level modules shall include drain valves for the hot and cold water lines, these valves are for the purpose of purging the system. After disinfecting the system with chlorine, the system must be purged by the site plumbing contractor to reduce the potential for valve damage. Once the water has been turned on to the fixtures, all toilets shall be flushed (by others) a minimum of three times per week to avoid surface rusting and damage to valves.
2. Stainless Steel Combination Security Lavatory/Water Closet: Entire fixture bracing and internal plumbing shall be type 304 stainless steel. Fixture body and bracing shall be fabricated from 14 gauge stainless steel. Fixture cabinet to be 15" wide. The construction shall be all welded with seamless exposed surfaces polished to a No. 4 satin finish. Toilet to have elongated bowl with contoured seat, integral crevice-free, self-draining flushing rim with positive afterfill. Toilet shall be provided with a Zurn model ZH6603-WS-1-MASD hydraulic flush valve and mechanical overflow prevention. Toilet to be blowout

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jet type, 1.6 gallons per flush, which requires minimum flushing pressure of 25 PSI and a maximum of 100 PSI. Trap shall be fully enclosed, maintain a minimum 3½" seal, and pass a 2⅛" ball. Lavatory shall be 5" deep and furnished with the following standard equipment; fast drain outlet, ball type air vent, self-draining soap dish and filler/bubbler. Unexposed interior surfaces to be coated with sound deadening fireproof insulation. Anchoring to be by standard (6) point system: Threaded rod, support plates, and fasteners furnished. Fixture to be certified for performance and load capabilities to 5,000 pounds. Toilet fixtures to be floor mount. Toilet to be either right hand or left. Metcraft or equivalent.

3. Handicap Stainless Steel Combination Security Lavatory/Water Closet: Handicapped fixture shall be interchangeable with standard fixture in the location of plumbing hook-up and anchorage locations. Entire fixture bracing and internal plumbing shall be type 304 stainless steel. Fixture body and bracing shall be fabricated from 14 gauge stainless steel. Fixture cabinet to be 15" wide at wall interface. The construction shall be all welded with seamless exposed surfaces polished to a No. 4 satin finish. Toilet to have elongated bowl with Entire contoured seat, integral crevice-free, self-draining flushing rim with positive afterfill. Toilet to be provided with a Zurn model ZH6603-WS-1-MASD hydraulic flush valve and mechanical overflow prevention. Toilet to be blowout jet type, 1.6 gallons per flush, which requires minimum flushing pressure of 25 PSI. Trap shall be fully enclosed, maintain a minimum 3½" seal, and pass a 2⅛" ball. Lavatory shall be 5" deep and furnished with the following standard equipment; fast drain outlet, ball type air vent, self-draining soap dish and filler/bubbler. Unexposed interior surfaces to be coated with sound deadening fireproof insulation. Anchoring to be by standard (6) point system: Threaded rod, support plates, and fasteners furnished. Fixture to be certified for performance and load capabilities to 5,000 pounds. Toilet fixtures to be floor mount. Toilet to be provided with grab bars. Metcraft or equivalent.

I. Fire Protection: Provide as shown below.

1. Each cell shall include one 2" dia. hole to the utility chase and one 2" dia. hole above the chase access door to the utility chase. These holes are for the installation of institutional sidewall sprinkler heads by others.

J. Insulation: Provide and install as shown below.

1. Insulation shall be a nominal 2" thickness. Insulation shall extend the full panel width and shall closely abut the window frame so that gaps and uninsulated sections are less than 1% of insulated panel area.
2. See ductwork for duct insulation.
3. See plumbing for hot water pipe insulation.

K. Exterior Wall "R" Value:

1. The exterior composite insulation system shall provide an "R" value of 14.5. The insulation system consists of exterior wythe, insulation and interior concrete wall panel.

L. Identification: Provide permanent marking inside the utility chase to identify manufacturer, product mark number, and date cast.)

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2.6 FINISHES

- A. Exposed Interior Steel: Surfaces shall be stainless steel, factory applied powder coating or epoxy paint (this may include furniture, plumbing fixture, window frames, door frames and HVAC grilles).
- B. Painted Concrete
 - 1. Concrete surface preparation for factory painted surfaces:
 - a. Comply with coating manufacturer's recommendations for removing contaminants, efflorescence, form coatings and laitance.
 - b. Fill and patch voids with a material compatible with subsequent primer and finishing materials.
 - 2. Acceptable interior coating system.
 - a. Primer/Filler: A three component, acrylic-modified cement.
 - 1) Performance Criteria:
 - a) Density: (ASTM C905), method B 105lbs/ft
 - b) Compressive strength: (ASTM C109 modified) 2000 psi
 - c) Tensile strength (ASTM C579) 500
 - 2) Application: Apply two coats of sufficient thickness to fill minor surface irregularities, achieving a uniform surface
 - 3) Ameron Coatings Amerlock 400 white or approved equal.
 - b. Finish Coats: A two component modified aliphatic amine epoxy.
 - 1) Performance Criteria:
 - a) Adhesion - method: ASTM D4541
Requirement: No less than 200 psi pull, average of three tests
 - b) Abrasion – method: ASTM D4060
Requirement: No more than 102 mg loss after 1,000 cycles
 - c) Hardness – method: ASTM D 3363
Requirement: Not less than HB rating
 - d) Moisture Vapor Transmission- ASTM F-1249
Requirement: Not more than 5.12 grams/square meter, per 24 hours
 - e) USDA- incidental food contact. FDA 21 CFR 175.300 direct food contact.
 - 2) Application: Apply one coat (sprayed) with a DFT (dry film thickness) of 8-10 mils. Full coat shall be back rolled to achieve a stipple finish. Apply

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- mist coat of 1.5-2.0 mils DFT over first full coat to achieve maximum hide.
 - 3) Color: Shall be Ameron color pure white with 84.0% reflectance. Color change during the warranty period shall be no greater than Ameron color pure white with 81.2% reflectance.
 - 4) Ameron coatings Amerlock 400 white or approved equal.
 - c. Unacceptable Interior Finish Conditions: Except as specifically approved, the following is a complete list of interior finish defects that are unacceptable and must be repaired.
 - 1) Ragged or irregular edges or form marks greater than 1/16" that have not been ground smooth.
 - 2) Any air pockets or voids greater than 1/4" in an exposed surface. Air pockets greater than .020" in size which are in a frequency greater than 1 per sq. ft., or smaller air pockets which are frequent and numerous and visible to a standing adult.
 - 3) Wall paint that is peeling.
 - 4) Wall paint that is less than 8 mils DFT.
 - 5) Cracks in the paint greater than .005 inch.
- C. Caulk Finishes: Caulk joints must be smoothly tooled. Lumps, double line tooling, ragged or uneven tooling is not allowed. The following additional requirements apply:
 - 1. Furniture caulk bead will be 1/4", +/- 1/8"
 - 2. Floor to wall caulk bead will be 1/2", +/- 1/8"
 - 3. Window caulk bead will be 1/8" x 1/4", +/- 1/8"
 - 4. Any seams or cracks greater than .020" in which contraband could be hidden shall be caulked.
- D. Concrete Finishes: Concrete surfaces shall be finished as follows.
 - 1. Exterior (outside) Wall, Dayroom Wall: PCI Finish Grade B - Steel Form Finish. Airholes over 1/4" in size and air holes greater than 1/8" but less than 1/4" occurring in concentrations of greater than one per two square inches shall be filled. The following additional module requirements shall apply:
 - a. Cracks greater than .005" will be repaired. Dayroom face cracks will be ground smooth.
 - b. Form marks and irregularities greater than 1/16" will be ground smooth.
 - c. Fins over 1/8" will be reduced.
 - d. Spalls will be repaired to original conformance
 - e. Exterior wall blemishes visible from 50' will be cosmetically blended
 - f. The exterior wall (minimum of 2" wythe) shall be cast horizontally.
 - g. Patches will be tight, without shrinkage cracks and conform to original plane
 - h. This finish is not paint ready
 - 2. Finish and Formed Surfaces of Cell Module Architectural Exterior Wall (if applicable):
 - a. Provide finishes for formed surfaces of the precast concrete exterior wall as indicated on the architectural drawings for each type of unit, and as follows:

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- 1) Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to the concrete
 - 2) Reveals: Incorporate horizontal and vertical reveals as shown on the drawings.
 - 3) Smooth Finish as Cast: Cast horizontally using flat, smooth, non-porous forms.
 - 4) Textured Finish: Achieve finish on exterior face of cell module wall by utilizing fluted, sculptured or textured form liners.
 - 5) Sandblast Finish: A medium sandblast finish shall be achieved by blasting away cementitious materials/sand matrix to match approved mock-up sample.
 - 6) Special Finishes: Exposed face to match approved mock-up sample or mock-up panel as specified on the drawings.
3. Sidewalls: PCI Commercial Grade – As Cast Finish. Concrete may have form marks, surface air holes, water marks, streaks of color or cast marks, scaling, minor grout bleed and minor chips or spalls. Large fins, large joint bleeding or honeycomb and large spalls will be repaired. The following additional requirements will apply:
- a. Sidewall finishes other than Commercial Grade shall be marked on erection drawings.
 - b. Cracks .013" and smaller do not require treatment.
4. Top of module, underside of floor: Surface shall be struck off with a screed and trowelled with a bull float to $\pm \frac{1}{4}$ " of true plane. The following additional requirements apply:
- a. Shim bearing areas will be hand finished locally smooth $\pm \frac{1}{16}$ "
 - b. Dowel holes shall be 8" deep and $\pm \frac{1}{4}$ " from true position.
5. Underside of Balcony: Shall be machine trowelled to a hard slick finish. The following additional requirements apply:
- a. No machine indentations or swirls are allowed.
 - b. Light junction box must be visible
- E. Concrete Cracks: It is normal for concrete to crack. Cracks will be measured for width and treated as follows:
1. Any working cracks or fresh cracks greater than .020" shall be evaluated by an engineer.
 2. Cracks larger than .013" shall be injected with epoxy designed for concrete repair.
 3. Cracks from .005" to .013" should be rubbed out if visible and aesthetically unappealing
 4. Cracks smaller than .005" may be ignored.
 5. Crack repairs will be cosmetically blended to the visual requirements of the surface receiving the repair.

PART 3 - EXECUTION

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3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SCOPE

- A. Erection of precast cell modules shall proceed only in accordance with this section.

3.3 RESPONSIBILITY

- A. Cell modules will be delivered by module manufacturer. The owner's representative shall inspect each unit upon arrival. All visible defects shall be noted on the bill of lading. Signing the bill of lading constitutes acceptance, subject to any notes on the bill of lading. The module manufacturer shall be notified in writing within 24 hours of the discovery of any hidden defect subsequently discovered. Unless the module manufacturer is responsible for erection by express separate contract, the module manufacturer shall not be responsible for any site handling damage.
- B. The cell module manufacturer shall supply the owner or owner's agent with erection drawings. Modules shall be handled and erected in accordance with the erection drawings and the module setting plan. The module manufacturer is not responsible for any damage due to failure to follow directions herein.
- C. Prior to erection, the erector shall be responsible for verifying all dimensions, centerlines, and grades that affect the modules. Erector shall establish joint locations, control points, benchmarks, offset lines and elevation marks prior to installation.
- D. Before erection, erector shall ensure that all materials supplied by the module manufacturer are at the job site and readily available. This includes, but is not limited to, modules, shims, pads, and connecting hardware.
- E. If required, site mechanical contractors shall loosen/remove bolts in the utility chase to make modules to module connections as noted in module manufacturers MEP drawings.
- F. Four (4) 2" diameter by 10" deep dowel holes shall be provided for each lower level module. These dowel holes are the responsibility of others, cell module manufacturer to provide dowel hole location on erection drawings. Connection requirements may change based on loading requirements. Refer to erection drawings for actual connection details.

3.4 ERECTION TOLERANCES

- A. Erection tolerances shall be as stated in PCI Manual 120, latest edition except as noted herein. Tolerances are not cumulative.
- B. Erection tolerances for cell module shall be:

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1. plan location on project grid datum, $\pm 1/2"$
2. top elevation; $\pm 1/2"$, individual finished floor cell elevation, $\pm 1/8"$
3. jog in alignment of faces, $1/4"$
4. balcony alignment at the walking surface after adjustment, $1/8"$
5. balcony alignment at the toe rail $1/4"$
6. joint width, $\pm 1/4"$
7. cell door frame or hinges plumb, $\pm 1/8"$

3.5 PROTECTION

- A. Protection of cell modules after erection is the responsibility of others. Any damage, not noted on the walk through inspection, after erection is not the responsibility of the cell module manufacturer.
- B. Cell modules stored at the job shall be placed on wooden cribbing, which is firm and level and placed as shown on the module manufacturer's erection drawings.
- C. Cell modules shall be protected from dirt, stains, rainsplash, and mechanical damage during job site storage and erection. Final cell module cleaning will be by others.
- D. Cell doors and chase doors shall not be opened until mutual inspection by module manufacturer and owner's representative is completed in accordance with Section 1.7. Schedule chase inspection before proceeding with chase connections. A minimum of 48 units, or one building, shall be scheduled for inspection at one time, or as mutually agreed.

3.6 SETTING MODULES

- A. Lifting shall proceed strictly in conformance with drawings.
- B. Only lifting and handling devices indicated on the drawings shall be used.
- C. Module elevation and plumb is adjusted by varying shim stack thickness. Shoot-in all foundation shims before setting module.
- D. It is the erector's responsibility to provide and install any temporary bracing, guys, or work platforms required to maintain position, stability, and alignment while modules are being set and connected.
- E. Remove both chase covers from lower cells and only bottom chase cover from the topmost cell. Protect open chase from weather.
- F. Schedule an inspection of all erected cells with the module manufacturer before proceeding with chase connections or as mutually agreed.
- G. All structural grout shall be high strength, non-shrink, and non-metallic, Dayton Superior or equivalent. Grout shall be furnished and installed by erector.
- H. Module to module connection is made with a threaded rod that is screwed into the bottom of the

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module and secured with a grout hole connection, either in the module below or in the foundation.

- I. Erector shall be responsible to verify module elevation and plumb before grout in sleeve connection has set.
- J. Individual grout pads are required at wall intersections along the front (dayroom) and back (exterior) walls. Grout is not required at side horizontal joints. Additional grouting may be required for specific structures as a result of seismic analysis.
- K. Balcony grout joint should be executed with a grout mix designated to approximate floor color. Bonding agent shall be used, grout shall be hard trowel finished. Follow cell fabricator's written instructions.
- L. Any visible grout bleed shall be cleaned before grout sets.
- M. Flush erection anchors pockets that will be exposed to weather after erection is complete shall be grout filled after erection.
- N. All weld connections shall be in accordance with ANSI/AWS D1.1 using E70XX low hydrogen electrodes. Any weld exposed to weather after construction shall be cleaned and coated with zinc rich paint, Galvacon, ZRC, or equal.
- O. Adjacent balconies shall be adjusted into alignment with jacks or clamps. Do not adjust a balcony more than 3/8" in a 48-hour period. If applicable, weld balconies when adjustment is complete.
- P. Chips or spalls that occur during erection shall be patched to similar shape, color and texture.

3.7 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION 134263

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Painting and finishing.
 - 7. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

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1.4 SUBMITTALS

- A. Product Data.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

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1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc
 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.

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4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- D. PVC Pipe: ASTM D 1785, Schedule 40.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 PIPING ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Bare Piping at Wall Ceiling and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.

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- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC or Steel Pipe Sleeves.
 - b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.2 PIPING JOINT CONSTRUCTION
- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
 - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

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- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.5 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.

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- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 210500

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:

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1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

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- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.
- E. Pipe-Label Colors:
 - 1. Background Color: Red.
 - 2. Letter Color: White.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Brass.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

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2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass S-hook.
 - 3. Valve-Tag Color: Red.
 - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum
 - 2. Fasteners: S-hook.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.

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- E. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 - 1. Valve-Tag Size and Shape:
 - a. Fire-Suppression Standpipe: 1-1/2 inches round
 - b. Wet-Pipe Sprinkler System: 1-1/2 inches round

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

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SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Fire-department connections.
 - 4. Sprinklers.
- B. Related Sections:
 - 1. Division 21 Section "Common Work Results for Fire-Suppression".

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Sprinkler system shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 5 P.S.I.
 - 2. Sprinkler Occupancy Hazard Classifications refer to drawings.

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1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Hydraulic Calculations.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include fabricating, and installing sprinkler systems and providing working plans per NFPA 13. Base calculations on results of fire-hydrant flow test.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 - 1. Notify Architect and Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
 - 2. Do not proceed with interruption of sprinkler service without Architect's and Construction Manager's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M or ASTM A 135.
- B. Piping Schedule shall be: All piping with threaded fittings shall be schedule 40 and all piping with grooved fittings shall be schedule 10.
- C. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.
- E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Anvil Star Piping Inc.
 - 2. Pressure Rating: 175 psig unless otherwise noted.
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.2 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

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- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Plastic, Pipe-Flange Gasket, and Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

- 1. Valves shall be UL listed or FM approved.
- 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

- 1. Standard: UL 1091 except with ball instead of disc.
- 2. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
- 3. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
- 4. Valves NPS 3: Ductile-iron body with grooved ends.

C. Check Valves:

- 1. Standard: UL 312.
- 2. Pressure Rating: 300 psig.
- 3. Type: Swing check.
- 4. Body Material: Cast iron.
- 5. End Connections: Flanged or grooved.

D. Iron Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Tyco Fire & Building Products LP.
 - f. Victaulic Company.
- 2. Standard: UL 1091.
- 3. Pressure Rating: 175 psig.
- 4. Body Material: Cast or ductile iron.
- 5. Style: Lug or wafer.
- 6. End Connections: Grooved.

2.4 FIRE-DEPARTMENT CONNECTIONS

A. Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-End & Croker Corporation.
 - b. Tyco Fire & Building Products LP
 - c. Potter Roemer
 - d. Elkhart Brass
2. Standard: UL 405.
3. Type: As indicated on drawings.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, lugged swivel connections, and check devices or clappers.
7. Caps: Lugged type, with gasket and chain.

2.5 SPRINKLERS

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

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
3. Refer to drawings for sprinkler types and applicable locations.

2.6 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink, and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

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- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. Powder driven inserts are not allowed.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Pressurize and check preaction sprinkler system piping and air-pressure maintenance devices.
- N. Fill sprinkler system piping with water.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

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1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels. Sprinklers may be centered in tile either by hard pipe or with flexible connectors. Connectors shall be UL 2443 listed, Flex Heads Industries or equal.
- B. Sprinkler Head Location: Sprinkler heads shall be installed no closer than 4 inches to any Ceiling grid or wall.
- C. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.7 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for Piping:
 1. Piping with Fitting or Sleeve Protruding from Wall: deep pattern.

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2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces cast brass with polished chrome-plated finish.

3.8 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 1. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PVC.
 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Stack sleeve fittings.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."

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3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. PVC-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
4. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PVC.
5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - d. All exterior sleeves shall be sealed water tight.
6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. PVC-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Energize circuits to electrical equipment and devices.
 5. Start and run excess-pressure pumps.

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6. Coordinate with fire-alarm tests. Operate as required.
 7. Coordinate with fire-pump tests. Operate as required.
 8. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 211313

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SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Plumbing demolition.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:

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1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Escutcheons.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

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- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

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2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
- B. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- D. PVC Pipe: ASTM D 1785, Schedule 40.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

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2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

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- 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing. Valves located above ceilings shall be positioned no further than arms length away from accessible ceiling opening.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

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- b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- P. Verify final equipment locations for roughing-in.

- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.

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3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. 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 the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. As specified in Division 03 Section.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

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2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F
- J. Code Letter Designation:
 - 1. Motors 15HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors smaller than 15HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 1. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

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2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

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SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- C. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

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

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2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

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

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

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

1. Presealed Systems.

- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

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2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping (All sizes): Galvanized-steel-pipe sleeves Sleeve-seal fittings
 2. Exterior Concrete Walls below Grade:
 - a. Piping (All sizes): Cast-iron wall sleeves with sleeve-seal system.

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- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping (All sizes): Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping (All sizes): Galvanized-steel-pipe sleeves.
5. Interior Partitions:
 - a. Piping (All sizes): Galvanized-steel-pipe sleeves.

END OF SECTION 220517

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SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

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. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish. and setscrew fastener.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

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. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Thermowells.
5. Dial-type pressure gages.
6. Gage attachments.
7. Test plugs.
8. Test-plug kits.

- B. Related Sections:

1. Section 21 "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Section 21 "Fire-Suppression Standpipes" for fire protection pressure gages.
3. Section 21 "Wet-Pipe Sprinkler Systems"
4. Section 21 "Dry-Pipe Sprinkler Systems" for fire protection pressure gages.
5. Section 22 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
6. Section 22 "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

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- B. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft Inc.
 - 2. REOTEMP Instrument Corporation.
 - 3. Terice, H. O. Co.
 - 4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 5. Weiss Instruments, Inc.
 - 6. WIKA Instrument Corporation - USA.
 - 7. Winters Instruments - U.S.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled type(s); stainless steel with 5-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.

- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. REOTEMP Instrument Corporation.
 - c. Terice, H. O. Co.
 - d. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device rigid, backrigid, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Terice, H. O. Co.
 - b. REOTEMP Instrument Corporation.
 - c. Weiss Instruments, Inc.
 - d. WIKA Instrument Corporation-USA.

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2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle or Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum or brass and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. REOTEMP Instrument Corporation.
 - c. Trerice, H. O. Co.
 - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - e. Weiss Instruments, Inc.
 - f. WIKA Instrument Corporation - USA.

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g. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass or Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle], with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:
 1. Flow Design, Inc.
 2. National Meter, Inc.
 3. Peterson Equipment Co., Inc.
 4. Trerice, H. O. Co.
 5. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 6. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic self-sealing rubber.

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2.8 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flow Design, Inc.
 - 2. National Meter, Inc.
 - 3. Peterson Equipment Co., Inc.
 - 4. Trerice, H. O. Co.
 - 5. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 6. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- F. Install valve and snubber in piping for each pressure gage for fluids.
- G. Install test plugs in piping tees.

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H. Install thermometers in the following locations (May not be shown on drawings):

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Outlet of all master mixing valves.

I. Install pressure gages in the following locations(May not be shown on drawings):

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 160 psi.
- B. Scale Range for Domestic Water Piping: 0 to 200 psi].

END OF SECTION 220519

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Bronze angle valves.
- 2. Brass ball valves.
- 3. Bronze ball valves.
- 4. Bronze lift check valves.
- 5. Bronze swing check valves.
- 6. Bronze gate valves.

B. Related Sections:

- 1. Section 22 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
- 2. Section 22 "Domestic Water Piping" for valves applicable only to this piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

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1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- C. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- B. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.

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5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Nonmetallic Disc:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Kitz Corporation.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: NBR, PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

B. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Kitz Corporation.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.

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2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

2.5 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

B. Class 250, NRS, Iron Gate Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.

- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

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3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or gate valves.
 - 2. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

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2. Ball Valves: Two piece, full port, brass or bronze with brass] [bronze] [stainless-steel] trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125nonmetallic-to-metal seats.
4. Iron Gate Valves: Class 125NRS.

3.7 STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, bronze] with bronze trim.
3. Bronze Swing Check Valves: Class 125nonmetallic disc.
4. Bronze Gate Valves: Class 150, NRS.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
4. Iron Gate Valves: Class 125, NRS.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

- B. Related Sections:

1. Section 05 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

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1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Unistrut Corporation; Tyco International, Ltd.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Plastic Coating Polyurethane.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ERICO International Corporation.
 2. PHS Industries, Inc.
 3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 4. Rilco Manufacturing Co., Inc.
 5. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

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2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners are not acceptable.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic or Stainless steel.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

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2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

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- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:

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- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

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4. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

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- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.

1.3 ACTION SUBMITTALS

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

1.4 COORDINATION

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

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6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: [Brass, 0.032-inch or Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
 - 7. Identification of potable and non-potable water.
 - a. In all buildings where two or more water distribution system, one potable water and the other non-potable water, are installed, each system shall be identified either by color marking or metal tags as required by ASME A13.1. Reclaimed water systems shall be identified using color coded Pantone Purple 522C and marked with the statement "NONPOTABLE WATER - NOT FOR HUMAN CONSUMPTION."

- B. Pipe Label Color: Refer to ASME (ANSI) Standard A13.1-2007.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering

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hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

- a. Cold Water: 2 inches, round.
- b. Hot Water: 2 inches, round.
- c. Low-Pressure Compressed Air: 2 inches, round.

END OF SECTION 220553

SECTION 220700 - PLUMBING 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. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
- 2. Insulating cements.
- 3. Adhesives.
- 4. Mastics.
- 5. Lagging adhesives.
- 6. Sealants.
- 7. Factory-applied jackets.
- 8. Tapes.
- 9. Corner angles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Submittal:
 - 1. For adhesives and sealants, including printed statement of VOC content compliant with South Coast Air Quality Management District (SCAQMD) Rule #1168.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84,

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by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

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- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.
- e. Mon-Eco Industries, Inc.; 22-25.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.
- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.
- e. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

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

- a. Childers Products, Division of ITW; CP-35.
- b. Foster Products Corporation, H. B. Fuller Company; 30-90.
- c. ITW TACC, Division of Illinois Tool Works; CB-50.
- d. Marathon Industries, Inc.; 590.
- e. Mon-Eco Industries, Inc.; 55-40.
- f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

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1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-52.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
 - c. Marathon Industries, Inc.; 130.
 - d. Mon-Eco Industries, Inc.; 11-30.
 - e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

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- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
- 2. Width: 3 inches.
- 3. Thickness: 11.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:

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1. Draw jacket tight and smooth.
 2. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 3. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the

connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

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4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

- D. Do not field paint aluminum or stainless-steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water:

- 1. Pipe 1-1/4 inch and smaller: insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- 2. Pipe 1-1/2 inch and larger: insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

- B. Stormwater and Overflow:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: minimum 1/2" thick.

- C. Roof Drain and Overflow Drain Bodies:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: minimum 1/2" thick.

- D. Condensate and Equipment Drain Water:

- 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

END OF SECTION 220700

SECTION 220800 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections: Refer to Division 01 Section 019113 "General Commissioning Requirements for additional commissioning scope and requirements. All testing and commissioning requirements of that section shall be met.
- C. The Commissioning Team will include representatives of the Owner, Design A/E, General Contractor and Installing Subcontractors, BAS Subcontractor and Commissioning Authority (CxA).
- D. Scope of Plumbing equipment and systems commissioning
 - 1. Water heating equipment, heat exchangers, associated pumping and controls
 - 2. Domestic water booster pumps

1.2 CONTRACTOR'S RESPONSIBILITIES

- A. Attend the Commissioning Kick-off meeting and other Commissioning meetings as required.
- B. Attend construction phase coordination meetings.
- C. Attend testing, adjusting, and balancing review and coordination meetings.
- D. Submit completed manufacturer's start-up checklists for the equipment being commissioned. Manufacturer's start-up documents shall be provided in addition to the completed and signed Pre-Functional Checklists.
- E. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period. Provide meters, gauges and instruments for Functional Performance Testing.
- F. Perform all commissioning tests at the direction of the CxA.
- G. Complete tasks required to correct items noted by the CxA in the Deficiency Log.
- H. Participate in systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

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- I. Provide O&M data including warranties, tables, recommended maintenance schedules, check-lists, spare parts lists, wiring and parts diagrams, points of contact for service, for all equipment, systems and controls being commissioned.
- J. Provide training of the Owner's operations and maintenance personnel in accordance with the project's construction documents and commissioning plan.
- K. Provide information requested by the CxA for final commissioning documentation.

1.3 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual Electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Provide a Commissioning Plan.
- C. Provide Functional Performance Checklists.
- D. Direct commissioning testing.
- E. Maintain and distribute the deficiency logs.
- F. Verify that the training of the Owner's personnel is complete and documented.
- G. Provide a Preliminary Commissioning Summary Report.
- H. Provide a Final Commissioning Report.

1.4 PROCESS

- A. Functional Performance Testing will commence after preliminary punch list items are completed by the Contractor. Functional Performance Testing will not be scheduled until the completed Pre-Functional Checklists are received by the Commissioning Authority.

1.5 SUBMITTALS

- A. Certificate of Readiness indicating the Plumbing systems are ready for Commissioning.
- B. Manufacturer's start-up checklists.
- C. Flushing and pressure test reports.
- D. Disinfection Reports.

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- E. Sixty (60) days before any plumbing equipment testing is conducted, provide an overall testing plan and schedule for plumbing systems that lists the equipment, modes to be tested, dates of testing and parties required to conduct the test. Put this information in to the master construction schedule. Keep the plan and schedule updated.

1.6 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA:

1. Approved submittals with designer review comments of submittals resolved, operation and maintenance manuals, and assistance in drafting the systems manuals, and other documents and reports requested by the Commissioning Authority in searchable pdf format
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase on as built markup of the design documents (plans and specifications)
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for Plumbing systems, assemblies, equipment, and components to be verified and tested.
4. Schedule indicating when Plumbing systems, subsystems, equipment, and associated controls will be ready for functional testing. The date for permanent connection of power is required.
5. Provide, documentation of completion of flushing and pressure test reports and certificates.
6. Corrective action documents.
7. Any additional information requested by the CxA.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for performing procedures presented in specification and contract drawings as detailed in the Functional Performance Tests (FPT). Members of the designated Commissioning Team shall witness various portions of the commissioning process. Commissioning Team members shall sign-off on appropriate sections after verifying installation, operation, or documentation. Final sign-off shall be by the Owner and CxA.
- B. Any test ports, gauges, test equipment, etc., needed to accomplish the functional performance tests shall be provided by the Contractor.
- C. Contractor shall provide to the Commissioning Team documentation of calibration of controls. Documentation shall include dates, setpoints, calibration coefficients, control loop verification, and other data required to verify system check-out. Documentation shall be dated and initialed by field engineer or technician performing the work.

3.2 TESTING PREPARATION

- A. Certify in writing the Plumbing systems, subsystems, and equipment and controls have been installed, calibrated, started and are operating per the Contract Documents.
- B. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- C. Inspect and verify the position of each device and interlock identified in the sequences, control schematics and or on checklists.
- D. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- E. Testing Instrumentation: Install measuring instruments and logging devices to record test data if directed by the CxA in the Commissioning Plan.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning tests at the direction of the CxA.
- B. Refer to the Section 019113 General Commissioning Requirements and the commissioning plan for the scope of Plumbing testing.
- C. Testing Strategies and Sampling: Refer to commissioning plan for minimum sampling strategies and functional performance test requirements.
- D. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of controllers and sensors.
- E. The CxA shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.
- F. Tests will be performed using design conditions whenever possible.

3.4 INSTRUMENTATION

- A. Instrumentation for Functional Performance Testing and data recording will be provided by the Contractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of ASPE Standards.

3.5 INSTALLATION VERIFICATION

- A. Before system start-up begins, the Contractor shall conduct a final installation verification audit. The Contractor shall be responsible for completion of work including change orders and punch list items to the Owner's satisfaction.
- B. If work is found to be incomplete, incorrect, or non-functional, the Contractor shall correct the deficiency before system start-up work proceeds.

3.6 FUNCTIONAL PERFORMANCE TESTING

- A. The objective of the Functional Performance Testing is to advance the building systems from a state of substantial completion to full dynamic operation in accordance with the specified design requirements, design intent, and Owner requirements.
- B. Functional Performance Testing begins after all manufacturer's start-up forms have been completed, submitted, and reviewed by the CxA, and after Test and Balance has been completed.
- C. Functional Performance tests for the systems to be commissioned are defined in the Commissioning Plan. These tests are intended to be conclusive but may require minor modifications as system operation dictates.
 - 1. Field testing plans and testing requirements are specified in Division 22 Sections and construction documents.
 - 2. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 22 Sections. Perform pipe system cleaning, flushing, and hydrostatic testing. Provide cleaning, flushing, testing, and treating completion confirmation and final reports to the CxA.
 - 3. Provide technicians, instrumentation, tools, and equipment to test performance of systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item to be tested.

3.7 NON-CONFORMANCE

- A. The CxA will record the results of the Functional Performance Tests. All deficiencies, non-conformance issues, or test failures will be noted and reported to the Contractor in a deficiency list or in a punch-list format.
- B. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
- C. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owners Representative.

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D. Re-testing:

1. If a Functional Performance Test fails, corrections shall be made to the deficient equipment or systems by the Contractor. The systems will be re-tested until they pass the Tests.
2. The time/cost for the CxA to perform any re-testing required because of improper set up of the systems by the Contractor or failed functional or performance tests will be back-charged to the Contractor (who may choose to recover costs from the party responsible for executing faulty equipment start-up/checkout and associated checklists). This includes instances where a specific item was overlooked in the equipment start-up and checkout procedures, reported to have been successfully completed, but determined during Functional Performance testing to be faulty.
3. Any required re-testing by any Contractor or vendor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

3.8 OWNER STAFF TRAINING

- A. The Commissioning Authority will coordinate training with the Owner and Contractor. The Owner will provide direction on the level of training and training requirements as well as the personnel requiring training. The Contractor will coordinate the scheduling of training.
- B. The Contractor and associated manufacturer's representatives shall provide required training to operational staff. The Contractor training sessions shall provide a detailed analogy of systems operation and maintenance.
- C. Training shall be recorded by the Contractor and documentation shall be provided to the Commissioning Authority.

END OF SECTION 220800

SECTION 221116 - DOMESTIC WATER PIPING

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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 QUALITY ASSURANCE

- A. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect Construction Manager and Owner no fewer than two Insert number days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

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2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.

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- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 125 psig minimum at 180 deg F.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a division of Watts Water Technologies, Inc.
 - e. Wilkins; a Zurn company.

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2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.

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- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- R. Install thermostats in hot-water circulation piping.
- S. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for

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specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

- F. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

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- c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

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- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

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- d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, shall be one of the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.
 - 3. Mechanical-joint, ductile-iron pipe; standard- or compact-pattern, mechanical-joint fittings; and mechanical joints.
 - 4. Push-on-joint, ductile-iron pipe; standard- or compact-pattern, push-on-joint fittings; and gasketed joints.
- E. Under-building-slab, domestic water piping, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping shall be:

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1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

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SECTION 221119 - DOMESTIC WATER PIPING 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. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Trap-seal primer valves.
13. Specialty valves.

- B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.

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1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; a division of Watts Water Technologies, Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 2. Standard: ASSE 1001.
- 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
- 4. Body: Bronze.
- 5. Inlet and Outlet Connections: Threaded.
- 6. Finish: Rough bronze Chrome plated.

- B. Hose-Connection Vacuum Breakers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. MIFAB, Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - e. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
 - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

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2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated Rough bronze.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; a division of Watts Water Technologies, Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; a division of Watts Water Technologies, Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Refer to drawings.
7. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

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B. Hose-Connection Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
 - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 1/2 or NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Corporation; Bell & Gossett Div.
 - c. NIBCO Inc.
 - d. TACO Incorporated.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Type: Ball valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a division of Watts Water Technologies, Inc.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.

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4. Type: Exposed-mounted Cabinet-type, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded [union] inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

B. Individual-Fixture, Water Tempering Valves <Insert drawing designation if any>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Lawler Manufacturing Company, Inc.
 - b. Leonard Valve Company.
 - c. Powers; a division of Watts Water Technologies, Inc.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2-1/2 to NPS 4: 0.045 inch 0.062 inch 0.125 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.8 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. Oatey.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

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2. Mounting: Recessed.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Acorn Engineering Company.
 - b. IPS Corporation.
 - c. Oatey.
2. Mounting: Recessed.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze or Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle Operating key.
13. Operation for Finished Rooms: Wheel handle Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

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2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products.
 - e. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
2. Standard: ASME A112.21.3M for concealed exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Operating Keys(s): One with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Josam Company.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products.
 - d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - e. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M for concealed exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Vacuum Breaker:
 - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
 - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
8. Operating Keys(s): One with each wall hydrant.

C. Moderate-Climate Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

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- a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts Drainage Products.
 - e. Woodford Manufacturing Company; a division of WCM Industries, Inc.
 - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
2. Standard: ASME A112.21.3M for concealed exposed-outlet, self-draining wall hydrants.
 3. Pressure Rating: 125 psig.
 4. Operation: Loose key.
 5. Inlet: NPS 3/4 or NPS 1.
 6. Box and Cover Finish: Polished nickel bronze Chrome plated.
 7. Operating Keys(s): One with each wall hydrant.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.12 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products.
 - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.13 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve solenoid valve and pump.

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- F. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- G. Install ground hydrants with [1 cu. yd.] of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- H. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- I. Install water-hammer arresters in water piping according to PDI-WH 201.
- J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Double-check, backflow-prevention assemblies.
 - 3. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
 - 4. Double-check, detector-assembly backflow preventers.
 - 5. Water pressure-reducing valves.
 - 6. Calibrated balancing valves.
 - 7. Primary, thermostatic, water mixing valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

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- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

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SECTION 221123 - FACILITY NATURAL-GAS PIPING

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. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Mechanical sleeve seals.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure down stream of service meter: Refer to drawings.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:

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1. Piping and specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Escutcheons.

B. Welding certificates.

C. Operation and Maintenance Data: For piping specialties.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

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1. Notify Architect and Owner in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Architect's and Owner's written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with gas service provider requirements.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe (Exterior Underground Application Only): ASTM D 2513, SDR 11.
 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

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3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
 - b. Casing: PVC Schedule 40 or Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
 - c. Aboveground Portion: PE transition fitting.
 - d. Outlet shall be threaded or flanged or suitable for welded connection.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: Refer to Appliance manufacturer.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

- B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

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2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - f. NIBCO Inc.
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated brass.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
 - 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 8. CWP Rating: 600 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

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E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - f. NIBCO Inc.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Flowserve.

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- b. Homestead Valve; a division of Olson Technologies, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
2. Body: Cast iron, complying with ASTM A 126, Class B.
 3. Plug: Bronze or nickel-plated cast iron.
 4. Seat: Coated with thermoplastic.
 5. Stem Seal: Compatible with natural gas.
 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 7. Operator: Square head or lug type with tamperproof feature where indicated.
 8. Pressure Class: 125 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kerotest Manufacturing Corp.
 - b. Lyall, R. W. & Company, Inc.
 - c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F].
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

I. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

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2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Meter Company.
 - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - c. Invensys.
 - d. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Meter Company.
 - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
 - c. Maxitrol Company.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.

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5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Pressure rating as required per system design see drawings

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Eaton Corporation; Controls Div.
 - b. Harper Wyman Co.
 - c. Maxitrol Company.
 - d. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Pressure rating as required per system design see drawings

2.6 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - f. Wilkins; Zurn Plumbing Products Group.

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2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
 - d. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Stainless steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.10 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

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1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.11 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Inspect natural-gas piping according to NFPA 54 or Local Code requirements to determine that natural-gas utilization devices are turned off in piping section affected.
- B. Comply with NFPA 54 or the Local Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 or the Local Code requirements for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

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2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- E. Copper Tubing with Protective Coating:
 1. Apply joint cover kits over tubing to cover, seal, and protect joints.
 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.
- G. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- H. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- I. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- J. Provide detectable marking tape on all underground piping.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 or the Local Code requirements for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

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- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access. Install all pipe valves above horizontal plane or in vertical rise.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall, Ceiling and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets and all equipment connections. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap, if required to be vented.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

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2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
5. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- T. Connect branch piping from top or side of horizontal piping.
- U. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- V. Do not use natural-gas piping as grounding electrode.
- W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.

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- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints (Above Ground Only):
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

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5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.
- C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
 4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 1. Alkyd System: MPI EXT 5.1D.

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- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
- c. Topcoat: Exterior alkyd enamel (semigloss).
- d. Color: Safety Yellow.

- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 or Local Code requirements and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 DEMONSTRATION

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

3.13 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
 - 2. Steel pipe with welded joints. Coat pipe and fittings with protective coating for steel piping.
 - 3. Copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.
- B. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints, 2" and smaller diameter.
 - 2. Steel pipe with wrought-steel fittings and welded joints, 2 1/2" and larger diameter.
 - 3. Copper tube with wrought-copper fittings and brazed joints.
- C. Containment Conduit: (For piping located underground beneath building) Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping or Schedule #40 solid core PVC, sealed and vented. See plans for details.

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3.14 INDOOR PIPING SCHEDULE:

- A. Aboveground piping 2" and smaller shall be the following:
 - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
 - 2. Copper tube with wrought-copper fittings and brazed joints.
 - 3. Steel pipe with malleable-iron fittings and threaded joints.
 - 4. Steel pipe with wrought-steel fittings and welded joints.
- B. Underground, below building, piping shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit: (For piping located in Air Plenums) Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- F. Containment Conduit: (For piping located underground beneath building) Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping or Schedule #40 solid core PVC, sealed and vented. See plans for details.

3.15 INDOOR PIPING SCHEDULE:

- A. Aboveground, piping 2 1/2" and larger shall be one of the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- B. Underground, below building, piping shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit: (For piping located underground beneath building) Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping or Schedule #40 solid core PVC, sealed and vented. See plans for details.

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3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller shall be listed for use with natural gas and shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
 - 3. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger shall be listed for use with natural gas and shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, lubricated plug valve.

END OF SECTION 231123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

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. Pipe, tube, and fittings.
- B. Related Sections:
 - 1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

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PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: Per CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. MIFAB, Inc.
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS (UNDERGROUND ONLY)

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

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- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
- D. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

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- J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- N. Install underground PVC piping according to ASTM D 2321.
- O. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

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- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- E. Install supports for vertical cast-iron soil piping every 15 feet.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

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- G. Install supports for vertical copper tubing every 10 feet.
- H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical PVC piping every 48 inches.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

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2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 3. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

- A. Aboveground, soil and waste and condensate piping shall be the following:
 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 2. Copper DWV tube, copper drainage fittings, and soldered joints.
- B. Aboveground, vent piping shall be the following:

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1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
- C. Underground, soil, waste, and vent piping and condensate piping shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING 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. Cleanouts.
 - 2. Floor drains.
 - 3. Trench drains.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Grease interceptors.

- B. Related Requirements:

- 1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

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1. Grease interceptors.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

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

- 1) Josam Company.
- 2) MIFAB, Inc.
- 3) Smith, Jay R. Mfg. Co.
- 4) Tyler Pipe.
- 5) Watts Drainage Products.
- 6) Zurn Plumbing Products Group.

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2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group; Light Commercial Operation.

2.3 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Section 220500 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall. Provide tamper proof access in all inmate areas.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

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- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- M. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- N. Provide tamper proof screws on all cleanouts, floor drains, floor sinks and trench drains in inmate areas.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

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3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221323 - SANITARY WASTE INTERCEPTORS

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. Grease interceptors.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
 - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:
 - 1. Interceptors.
 - 2. Piping connections. Include size, location, and elevation of each.
 - 3. Interface with underground structures and utility services.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTORS

- A. Grease Interceptors: Precast concrete complying with ASTM C 913.
 - 1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
 - 2. Structural Design Loads:
 - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
 - 3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.
 - 4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
 - 5. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover.
 - a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
 - b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

- A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.
- B. Set tops of manhole frames and covers flush with finished surface in pavements.
- C. Set tops of grating frames and grates flush with finished surface.
- D. Set metal and plastic interceptors level and plumb.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

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3.4 IDENTIFICATION

- A. Identification materials and installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
 - 1. Use warning tapes or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 221323

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SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

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. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
 - 2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Two year(s).
 - b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-Fired, STORAGE, Domestic-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Description: Manufacturer's proprietary design to provide at least 88 percent combustion efficiency at optimum operating conditions.
2. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.2 WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

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1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig
 - b. Capacity Acceptable: 20 gallon minimum.
 - c. Air Precharge Pressure: 50. psig
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.
 1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
 2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

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1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- J. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.
 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters [and storage tanks] specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.
 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 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 floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

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1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 221123 "Facility Natural-Gas Piping."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and- pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

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3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 221123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400

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SECTION 224000 - PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:

1. Faucets.
2. Flushometers.
3. Protective shielding guards.
4. Fixture supports.
5. Interceptors.
6. Disposers.
7. Water closets.
8. Urinals.
9. Lavatories.
10. Commercial sinks.
11. Showers.
12. Kitchen sinks.
13. Mop sinks.
14. Drinking fountains.
15. Water coolers.
16. Hose Bibb's and Hydrants

1.3 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

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1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.
- F. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- G. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- H. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.
- I. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- J. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 - 2. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 5. Water-Closet, Flushometer Tank Trim: ASSE 1037.

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1.5 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. 1 year Warranty Period for Commercial Applications.

PART 2 - PRODUCTS

2.1 LAVATORY AND SINK FAUCETS

- A. Lavatory and Sink Faucets:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Chicago Faucets.
 - c. Kohler Co.
 - d. Speakman Company.
 - e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Plumbing Products Group; Commercial Brass Operation.

2.2 SHOWER FAUCETS

- A. Bathtub and Shower Faucets:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Kohler Co.
 - c. Symmons Industries, Inc.
 - d. Leonard Valve Company.
 - e. Powers.
 - f. Zurn Plumbing Products Group; Commercial Brass Operation.

2.3 FLUSHOMETERS

A. Flushometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Coyne & Delany Co.
 - b. Hydrotek International, Inc.
 - c. Sloan Valve Company.
 - d. TOTO USA, Inc.
 - e. Zurn Plumbing Products Group; Commercial Brass Operation.

2.4 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Centoco Manufacturing Corp.
 - d. Church Seats.
 - e. Eljer.
 - f. Kohler Co.
 - g. Olsonite Corp.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGuire Manufacturing Co., Inc.
 - b. Plumberex Specialty Products Inc.
 - c. TCI Products.
 - d. TRUEBRO, Inc.

2.6 FIXTURE SUPPORTS

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

1. Josam Company.
2. MIFAB Manufacturing Inc.

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3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

2.7 HAIR AND SEDIMENT TRAPS

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

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Zurn Plumbing Products Group; Specification Drainage Operation.

2.8 DISPOSERS

- A. Disposers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. In-Sink-Erator; a div. of Emerson Electric Co.
 - b. KitchenAid.
 - c. Maytag Co.

2.9 WATER CLOSETS

- A. Water Closets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Kohler Co.
 - b. Eljer.
 - c. Zurn
 - d. TOTO USA, Inc.
 - e. American Standard Companies, Inc.

2.10 URINALS

- A. Urinals:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Kohler Co.

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- b. Eljer.
- c. Zurn
- d. TOTO USA, Inc.
- e. American Standard Companies, Inc.

2.11 LAVATORIES

A. Lavatories:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Kohler Co.
 - b. Eljer.
 - c. Zurn
 - d. TOTO USA, Inc.
 - e. American Standard Companies, Inc.

2.12 COMMERCIAL SINKS

A. Commercial Sinks:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Advance Tabco.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing Company.
 - d. Metal Masters Foodservice Equipment Co., Inc.
 - e. AERO Co.

2.13 SHOWERS

A. Showers:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Eljer.
 - b. Jacuzzi, Inc.
 - c. Kohler Co.
 - d. American Standard Companies, Inc.

2.14 KITCHEN SINKS

A. Kitchen Sinks:

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1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing Company.

2.15 MOP SINKS

A. Mop Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Crane Plumbing, L.L.C./Fiat Products.
 - b. Florestone Products Co., Inc.
 - c. Stern-Williams Co., Inc.
 - d. Zurn Plumbing Products Group; Light Commercial Operation.

2.16 DRINKING FOUNTAINS AND WATER COOLERS

A. Drinking Fountains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Oasis Corporation.

2.17 HOSE BIBB'S AND HYDRANTS

A. Hose Bibb's and Hydrants

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Zurn
 - b. Prier
 - c. WoodFord
 - d. J.R. Smith

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- G. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- H. Install counter-mounting fixtures in and attached to casework.
- I. Install fixtures level and plumb according to roughing-in drawings.
- J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- K. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

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- L. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- M. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- N. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- O. Install toilet seats on water closets.
- P. Install trap-seal liquid in waterless urinals.
- Q. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- S. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- T. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- U. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- V. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- W. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Connect inlet hose to dishwasher and outlet hose to disposer.
- X. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.
- Y. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- Z. Set bathtubs shower receptors and mop sinks in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- AA. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.
- F. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

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- E. Install fresh batteries in sensor-operated mechanisms.
- F. Adjust fixture flow regulators for proper flow and stream height.
- G. Adjust water cooler temperature settings.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
- C. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- D. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

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SECTION 224000 - PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:
 - 1. Faucets.
 - 2. Mop sinks.
 - 3. Hose Bibb's and Hydrants

1.3 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. NSF-61-G Compliance: Products in contact with domestic water for human consumption shall meet NSF-61-G and contain less than 0.25% (weighted average) of lead. All products shall be labeled with the Certification Mark NSF-61-G.
- B. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.5 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

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- a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. 1 year Warranty Period for Commercial Applications.

PART 2 - PRODUCTS

2.1 MOP SINK FAUCETS

A. Mop Sink Faucets:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Chicago Faucets.
 - b. T & S Brass and Bronze Works, Inc.
 - c. Zurn Plumbing Products Group; Commercial Brass Operation.

2.2 MOP SINKS

A. Mop Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Crane Plumbing, L.L.C./Fiat Products.
 - b. Florestone Products Co., Inc.
 - c. Stern-Williams Co., Inc.
 - d. Zurn Plumbing Products Group; Light Commercial Operation.

2.3 HOSE BIBB'S AND HYDRANTS

A. Hose Bibb's and Hydrants

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Zurn
 - b. Prier
 - c. WoodFord
 - d. J.R. Smith

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to roughing-in drawings.
- C. Set mop sinks in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- D. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

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3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.
- C. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- D. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224600 – SECURITY PLUMBING FIXTURES

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. Combination units.
 - 2. Water closets.
 - 3. Lavatories.
 - 4. Drinking fountains.
 - 5. Showers.
 - 6. Supports.

- B. Related Requirements:

- 1. Section 224000 Plumbing Fixtures.
 - 2. Refer to plumbing fixture schedule on plumbing drawings.

1.3 DEFINITIONS

- A. Accessible Service Space: Service area in secure space behind wall-mounted fixtures.
- B. Back-Access Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall or on wall, so installation and removal of fixture, piping, and other components are accessible only from service space behind wall.
- C. Front-Access Fixture: Security plumbing fixture designed to mount on wall with installation and removal from fixture side of wall, and with piping and other components accessible only from access panel in fixture.

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 security plumbing fixtures.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

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1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For security plumbing fixtures and components 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. Flushometer-Valve Repair Kits: Equal to 10 percent of quantity of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

- A. Combination Units: Back access, on floor, cabinet, with water closet and lavatory.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
 - 2. Material: 14 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
 - 3. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - 4. Ligature resistant push buttons and toilet skirt.
 - 5. Mounting: Bolts through wall sleeve into accessible service space.
 - 6. Water Closet:
 - a. Standard: IAPMO PS 61.
 - b. Bowl:
 - 1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
 - 2) Seat Surface: ASTM A480/A480M, No. 7 polished finish.
 - 7. Flushometer Valve:
 - a. Sloan.

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- b. Hydraulic operated flush valve.
 - c. Manual reset toilet overflow preventer.
- 8. Lavatory:
 - a. Standard: ASME A 112.19.3/CSA B45.4.
 - b. Location: In top of cabinet.
 - c. Receptor: Oval bowl with integral soap depression.
 - d. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
 - e. Filler Spout: Backsplash mounted.
 - f. Drain: Integral punched grid with NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
 - g. Dual temperature pneumatic valve.
- 9. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
- 10. Ligature resistant.
- B. Combination Units: ADA Compliant, back access, on floor, cabinet, with water closet and lavatory,
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
 - 2. Material: 14 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
 - 3. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - 4. Ligature resistant push buttons and toilet skirt.
 - 5. Mounting: Bolts through wall sleeve into accessible service space.
 - 6. Water Closet:
 - a. Standard: IAPMO PS 61.
 - b. Bowl:
 - 1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
 - 2) Seat Surface: ASTM A480/A480M, No. 7 polished finish.
 - 7. Lavatory:
 - a. Standard: ASME A 112.19.3/CSA B45.4.

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- b. Location: In top of cabinet.
 - c. Receptor: Oval bowl with integral soap depression.
 - d. Hot- and Cold-Water and Bubbler Supply Valves: Pneumatic-metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
 - e. Filler Spout: Backsplash mounted.
 - f. Drain: Integral punched grid with NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
8. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.

2.2 STAINLESS-STEEL WATER CLOSETS

A. Water Closets: Back access, back outlet, cabinet.

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
- 2. Material: 14 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
- 3. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
- 4. Cabinet: See fixture schedule.
- 5. Mounting: Bolts through wall sleeve into accessible service space.
- 6. Water Closet:
 - a. Standard: IAPMO PS 61.
 - b. Bowl:
 - 1) Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
 - 2) Type: Elongated, with back inlet, integral trap, and siphon-jet design with bottom outlet and contoured seat.
 - 3) Back-Outlet Connection: NPS 3, horizontal with cleanout and slip joint.
 - 4) Bottom-Outlet Connection: NPS 3, vertical.
 - 5) Seat Surface: ASTM A480/A480M, No. 7 polished finish.
 - 6) Punching: Two holes for installation of separate toilet seat.
- 7. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
 - a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.

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B. Water Closets: Back access, off floor, back outlet, compact.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
2. Standard: IAPMO PS 61.
3. Material: 0.078-inch--minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
4. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
5. Bowl:
 - a. Type: Elongated, with back inlet, integral trap, and blowout design with contoured seat.
 - b. Length to Wall: Approximately 19 inches.
 - c. Seat Surface: ASTM A480/A480M, No. 7 polished finish.
 - d. Punching: Two holes for installation of separate toilet seat.
6. Mounting: Bolts through wall sleeve into accessible service space.
7. Flushometer Valve.
8. Toilet Seat.
9. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
 - a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.
10. Material: 0.078-inch-minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
11. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
12. Bowl:

2.3 FLUSHOMETER VALVES

A. Flushometer Valves: Push button, diaphragm.

1. Sloan.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Integral check stops and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Consumption: 1.6 gal. per flush.
9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

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2.4 TOILET SEATS

- A. Toilet Seats:
 - 1. Standard: IAPMO Z124.5.
 - 2. Material: Plastic.
- B. Type: Commercial heavy duty.
 - 1. Shape: Elongated rim, open front.
 - 2. Hinge: Check.
 - 3. Hinge Material: Noncorroding metal.
 - 4. Color: White.

2.5 STAINLESS-STEEL LAVATORIES

- A. Lavatories: Back access.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
 - 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Material: 0.078-inch-minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
 - c. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - d. Receptor: Oval or rectangular bowl with integral soap depression and backsplash.
 - e. Hot- and Cold-Water and Bubbler Supply Valves: Pneumatic-metering type with push-button actuation, individual check stops, and backsplash- mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
 - f. Drain: Integral punched grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2/CSA B125.2.
 - 3. Accessories:
 - a. Toothbrush Holders: One on [each] [left] [right] side of backsplash.
 - b. Bubbler Location: On backsplash.
 - 4. Mounting: Bolts through wall into accessible service space.

2.6 DRINKING FOUNTAINS

- A. Drinking Fountains: Front access.

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1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Material: 14 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
 - c. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - d. Receptor: Bowl with backsplash.
 - e. Bubbler Supply Valve: Push-button actuation and backsplash- mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
 - f. Drain: Integral punched grid with NPS 1-1/4 tailpiece.
3. Waste Fittings: NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
4. Mounting: Z-clip and anchoring holes.

B. Drinking Fountains: Front access.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Material: 14 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
 - c. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - d. Receptor: Bowl with backsplash.
 - e. Bubbler Supply Valve: Push-button actuation and deck- mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
 - f. Drain: Integral punched grid with NPS 1-1/4 tailpiece.
3. Waste Fittings: NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
4. Mounting: Anchoring from the front with Z-clip and anchoring holes.

2.7 SHOWERS

A. Showers: Front access, surface wall mounted, ligature resistant.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.

2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Material: 14 gauge Type 304 stainless steel; ligature-resistant metal for internal piping and bracing.
 - c. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - d. Type and Configuration: Wall, with showerhead and soap dish.
 - e. Single Temperature Water Supply Valves: Pneumatic-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
 - f. Shower: Ligature-resistant, fixed-type head.
 - g. Soap Dish: Recessed, stainless steel.
3. Mounting: Bolts through wall sleeve into accessible service space.
4. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture.

B. Showers ADA accessible, front access, surface wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Willoughby Industries.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Material: 16 gauge Type 304 stainless steel; corrosion-resistant metal for internal piping and bracing.
 - c. Finish: ASTM A480/A480M, No. 4 polished finish on exposed surfaces.
 - d. Type and Configuration: Wall, with showerhead and soap dish.
 - e. Tempered-Water Supply Valves: Pneumatic-metering type with individual check stops complying with ASME A112.18.1/CSA B125.1.
 - f. Shower: Ligature-resistant, fixed-type head.
 - g. Soap Dish: Recessed, stainless steel.
 - h. Access to Internal Components: Vandal-resistant access panels.
3. Mounting: Bolts from fixture-mounted flanges into wall.

2.8 SUPPORTS

A. Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Wade Drains.

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- e. WATTS.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install security plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install back-access, stainless-steel fixtures as follows:
 - 1. Install wall sleeve in wall if indicated.
 - 2. Install fixture on wall sleeve or wall, as indicated, with access from accessible service space.
 - 3. Extend supply piping from service space to fixture.
 - 4. Install soil and waste piping from fixture and extend into service space.
 - 5. Install fixture trap in service space instead of below fixture drain.
- C. Install front-access, stainless-steel fixtures as follows:
 - 1. Install fixture support or mounting bracket.
 - 2. Install fixture on support; mount components inside of or attached to fixture.
 - 3. Extend supply piping from pipe space to fixture.
 - 4. Install trap below fixture and extend soil and waste piping into pipe space.
- D. Install fixture outlets with gasket seals.
- E. Install fixtures designated "accessible" according to ICC A117.1 for heights, dimensions, and clearances.
- F. Install toilet seats on water closets and combination units if seats are indicated.
- G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible fixtures.
- H. Seal joints between fixtures, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

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- I. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with requirements for water piping specified in Section 221116 "Domestic Water Piping."
- C. Comply with requirements for soil and waste drainage piping specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust flushometer valves and flow-control valves on fixtures.

3.5 CLEANING AND PROTECTION

- A. After installing fixtures, inspect and repair damaged finishes.
- B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224600