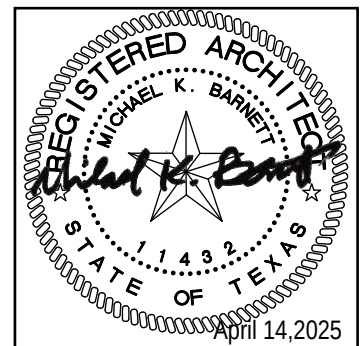




JPS Medical Home Southwest

Construction Document

JPS Medical Home Specialty Pharmacy
Fort Worth, Texas



April 14, 2025

PROJECT MANUAL

JPS Medical Home Specialty Pharmacy Fort Worth, Texas

April 14, 2025

Construction Documents

Owner

JPS Health Network
1575 South Main Street
Fort Worth, Texas 76104

Architect

SBL Architecture, Inc.
1000 Ballpark Way, Suite 200.
Arlington, Texas 76011
Telephone: 817-792-2100

Mechanical, Electrical and Plumbing Engineers

B&H Engineers, Inc.
Telephone: 214-469-1670

SBL Architecture, Inc. Project Number:

P30481.11

END OF DOCUMENT

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SECTION 00 11 19
REQUEST FOR PROPOSALS

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END OF SECTION 00 11 19

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

The General Contractor (Contractor) is in the process of obtaining subcontractor and material man bids and securing a Cost Proposal to the Owner.

1.1 DEFINITIONS

- A. Definitions listed in the Owner's edited AIA 201 General Conditions of the Contract for Construction are applicable to the Bidding Documents.
- B. Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.
- C. A Proposal from the Contractor is a Complete and signed proposal to do the Work as described in the Drawings and Specifications and these and other Contract and Bidding Documents, for the amount proposed therein and submitted in accordance with the proposal and bidding document.
- D. Bid from the subcontractor is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents.
- E. A Unit Price is an amount stated as a price per unit of measurement for materials or for material and services as described in proposed Contract Documents.
- F. A Sub-bidder is a person or entity who submits a bid to a Bidder for materials or labor for a portion of the Work.

1.2 CONTRACTOR AND SUB CONTRACTOR'S REPRESENTATIONS

- A. Each party by submitting a Proposal or Bid to Contractor or the Owner respectively represents that:
 - 1. It has read and understands the Bidding Documents and Contract Documents.
 - 2. It has visited the site and has become familiar with the local conditions, laws, rules and otherwise stated expectations under which the Work is to be performed and have compared such observations with the requirements of the proposed Contract Documents.
 - 3. The Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception and to that the scope of work can be constructed by the necessary means and methods and without exception for obvious information omitted from the Bidding Documents.
 - 4. The local laws governing noise, dust, and general working conditions have been investigated and incorporated into the schedule and general conditions.
 - 5. The Hospital Policies, Procedures, phasing plans, staging plans and work hours governing the job site expectations and working conditions have been read and where necessary taken into account by the subcontractor AND THEREFORE INCLUDED IN THE PROPOSED SUM.

PART 2 - BIDDING DOCUMENTS

2.1 PROPOSAL AND BIDDING DOCUMENTS

A. The Contractor and Subcontractor Proposal and Bidding Documents include:

1. Specifications
2. Drawings
3. Owner Contractor Agreement
4. Specification Bid Form
5. Owners Cost (Bid) Form (electronic transfer)
6. Any specific additional written bidding instructions by the Owner
7. Any Addenda issued prior to and approved Modifications issued after execution of the Contract.

B. Sub-bidders shall use the complete Bidding Documents in preparing Bids.

2.2 INTERPRETATION

A. The Contractor and each party proposing to the Contractor shall take note of the items below to the extent that it relates to the Work for which the Proposal is submitted and shall propose a cost for the Work only after careful consideration of the items listed:

1. Carefully study the Drawings and Specifications;
2. Review each Administrative Specification section;
3. Reviewed each Article of the A201;
4. Compare the Bidding Documents to each other, the Specifications Sections to the table of contents and the list of drawings to each page of drawings provided to ensure all information is available and related to the Work;
5. Examine the site and local conditions
6. Report to the Architect errors, inconsistencies or ambiguities discovered.
7. Sub-bidders send written requests for clarification or interpretation of Bidding Documents to both the Contractor and Architect for receipt at least ten (10) days prior to the date for submittal of Bids.
8. Interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.
9. Address questions relating to the Bidding Documents or proposed Contract Documents to the Architect.

2.3 SUBSTITUTIONS

A. Follow the instruction in the Specifications and Owner edited AIA 201 General Conditions of the Contract.

2.4 ADDENDA

A. Addenda will be available electronically

PART 3 - EXECUTION

SUB-BIDDERS AND VENDOR TERMS AND CONDITIONS

3.1 QUALIFICATIONS

- A. Sub-bidders for mechanical, electrical, plumbing, drywall and fire protection shall satisfy the following criteria for consideration as a subcontractor. Contractor (s) shall verify that each sub-bidder meets these qualifications prior to accepting the sub-bid.
- B. The sub-bidder shall be financially sound and able to provide the bonds required in the Owner's edited AIA 201 General Conditions of the Contract.

3.2 TERMS AND CONDITIONS

- A. THERE ARE NO EXCLUSIONS – The sub- bidder or vendor must use clarifications to indicate scope of work not in their contract but the term exclusion implies the sub- bidder and vendor is not performing work within their normal parameters as shown on the Drawings and Specifications, or implied therein.
- B. REVIEW OF DOCUMENTS - The sub-bidder has reviewed all the documents and requested additional information where necessary and is in agreement that the bid provided includes all the Work necessary for a complete scope either shown or implied on the Drawings and Specifications and has waived the right to additional compensation for items known but not identified in advance of the proposed bid.
- C. REVIEW OF SITE – The sub- bidder has reviewed the site and requested additional information and is in agreement that the bid provided includes all the Work necessary for a complete scope either shown or implied on the Drawings and Specifications and has waived the right to additional compensation for items known but not identified in advance of the proposed bid.

3.3 UNIT COST

- A. The sub- bidder shall provide the unit costs requested in the specifications by the Architect with accuracy and will follow those unit costs when proposing deductive or additive changes in cost for scope changes in the Work.
- A. The Contractor must provide the list of unit costs, in the format requested in these Specifications. See Sections 01 22 00 and 01 22 15.
- B. The subcontractor must provide unit costs to the Contractor for use in the proposal per the terms and conditions of this and the other Contract Documents.

3.4 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

- A. The Agreement will be written on the form that is included in these Administrative Specifications.

END OF SECTION 00 21 13

SECTION 00 25 13

PRE - PROPOSAL CONFERENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 MEETING COORDINATION:

- A. Architect's Responsibility: provide a written agenda and provide administration of the meetings.
- B. Contractor's Responsibility: ensure proper attendance of all bidding subcontractors and suppliers, ensure compliance with hospital guidelines for areas to be observed and those areas off limits, maintain log of questions asked and corresponding responses, ensure each vendor has access to the areas necessary for a complete review of the Work.
- C. Site Walk Thru

1.3 PRE PROPOSAL CONFERENCE:

- A. The Contractor will ensure the participation of every qualified subcontractor and vendor necessary to review no less than the following areas of the building where applicable:
 - 1. Site conditions
 - 2. Building conditions
 - 3. Tie in points for utilities
 - 4. Above ceiling inspection
 - 5. Structural framing types
 - 6. Existing finishes
 - 7. Area where the Work will take place
 - 8. Areas for staging
 - 9. Areas for access
- B. The Architect shall conduct a meeting. The meeting agenda should include the following items as a minimum:
 - 1. Scope of the Work
 - 2. Phasing
 - 3. Hospital policies for safety, ICRA, ILSM
 - 4. Insurance / Bonds
 - 5. Supplier Diversity

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 00 25 13

PRE-PROPOSAL CONFERENCE

00 25 13 - 1

SECTION 00 41 33

PROPOSAL FORMS

The Proposing Contractor, that this Proposal is made, without collusion with any other person, firm, corporation; and that he/she has carefully examined Contract Documents and has carefully examined the site and the locations, conditions and classes of materials of the proposed work; and agrees that he/she will provide the necessary labor, machinery, tools, apparatus, and other means of construction, and will do the work and furnish the materials called for in the Contract Documents, and in the manner prescribed. The Proposal shall include the costs of the purchase of Subcontractor Performance and Payment Bonds.

It is further agreed that the quantities of work to be done and materials to be furnished may be increased or diminished as may be considered necessary, in the opinion of the Architect or Owner, to complete the Project fully as planned and contemplated.

The Contractor's Performance and Payment Bonds (reference Section 00 61 13), if required by the Owner, will be submitted to the Owner no later than Contract Execution Date, or if the Work is to start before Contract Execution Date, in response to a Letter of Intent, the Contractor will, before starting work, submit evidence satisfactory to the Owner that such bonds will be furnished if this bid is accepted.

It is understood that the Owner reserves the right to reject any bids, to accept or reject any alternates, or to accept any combination of alternates considered advantageous to the Owner.

Addenda, alternates, and related information shall be provided on the Owner's bid spread sheet forms. The Contractor shall fill out those forms in order to be considered for the project. Additional information required shall be in the format noted in Section 00 21 13.

EXHIBIT "A" - RFP PROPOSAL CHECKLIST
EXHIBIT "D" - BID FORM
EXHIBIT "E" - VENDOR VERIFICATION FORM
EXHIBIT "F" - GOOD FAITH EVALUATION FORM
EXHIBIT "G" - CONFLICT OF INTEREST QUESTIONNAIRE FORM
EXHIBIT "H" - RESPONDENT'S PROPOSED AMENDMENT FORM
EXHIBIT "I" - PROPOSAL SIGNATURE FORM

END OF DOCUMENT 00 41 33

**Refer to REQUEST FOR COMPETITIVE SEALED PROPOSALS
FOR GENERAL CONTRACTOR SERVICES for Procurement and Contract
Requirements**

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting and processing product substitutions after execution of the Agreement.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitution requests will only be considered after execution of agreement except when a specified product or system is no longer available.
 - 2. Owner-requested cost-reduction proposals shall be submitted on Substitution Request Form.

1.3 DESIGN REQUIREMENTS

- A. Materials, products, and equipment included in the Contract Documents are specified for the purpose of establishing a minimum standard of quality, cost, appearance, design, and function. It is not the intent to limit the acceptance of materials, products or equipment specified, but rather to name or describe a material, product or piece of equipment as the absolute minimum standard that is desired and acceptable. Where proprietary names are used, whether or not followed by the words "or acceptable substitution," requests for substitution will nevertheless be considered if properly submitted to and received by the Architect prior to the designated date.

1.4 SUBMITTALS

- A. Substitution Requests after Award of Contract: Submit 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.
- B. The Substitution Request Form included as an attachment to this Document shall be used for all Substitution requests. Failure to use the attached Substitution Request form, or failure to fully execute the form as required, will result in rejection of the proposed substitution request without review.
 - 1. Do not make substitution request with shop drawings or product data submittals.
- C. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - 1. Statement indicating why specified material or product cannot be provided.
 - 2. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - 3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 5. Samples, where applicable or requested.
 - 6. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - 7. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

8. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
9. 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 lack of availability or delays in delivery.
10. Cost information, including a proposal of change, if any, in the Contract Sum.
11. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
12. 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.
13. Only one substitution request will be reviewed for each product or system.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within 60 days after award of Contract. Requests received after that time may be considered or rejected at the discretion of Architect.
- B. 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:
 1. 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.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
- C. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
 1. Evidence that the proposed product does not require extensive 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

3.1 CONTRACTOR RESPONSIBILITIES

- A. All requests shall originate from the Contractor. Manufacturers, manufacturer's representatives, dealers, distributors, suppliers, and subcontractors shall not direct or make requests to substitute equipment or materials.
- B. Substitutions shall be submitted to the Architect only; no substitutions shall be submitted directly to any consultant, the Owner, or any of the Owner's consultants.
- C. All requests for substitutions shall be accompanied by manufacturer's product data, specifications, drawings, catalog cuts, samples, installation instructions, performance data, list of projects completed of similar size and scope, and other references and information necessary to completely describe the item, and to facilitate a thorough and complete review by the Architect. Requests not meeting all these requirements may be rejected without evaluation.

3.2 ARCHITECT'S ACTION

- A. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week 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 7 days of receipt of additional information or documentation, whichever is later.
- B. Approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Architect at the time decision is rendered. Approval therefore is interim in nature and subject to re-evaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed. In proposing items for consideration, Contractor assumes all risk, costs, and responsibility for item's final acceptance, compliance with the Contract Documents, integration into the Work, and performance.

3.3 IMPLEMENTATION

- A. Form of Acceptance: Change Order.
- B. If Architect cannot make a decision on use of a proposed substitution within time allocated, or if substitution request is rejected, provide the basis of design product originally specified.
- C. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall remove the substituted product, material, or item and provide the originally-specified product at no additional cost to Owner.

3.4 ATTACHMENTS

- A. Substitution Request Form.

END OF SECTION 01 25 00



SUBSTITUTION REQUEST (After the Bidding Phase)

Project: JPS Health Network Substitution Request Number: _____
Project Name _____ From: _____
To: _____ Date: _____
_____ A/E Project Number: Project Number
Re: _____ Contract For: _____

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

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____
History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached - REQUIRED BY A/E

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: _____ (\$ _____).

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

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

SUBSTITUTION REQUEST (Continued)

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 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

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

SECTION 01 26 63

CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, Specifications and Contract Documents

1.2 DESCRIPTION OF WORK:

- A. The procedures set forth hereinafter establish proper control of construction changes and related administrative actions.

1.3 RECORDING, PROCESSING AND DOCUMENTATION OF CHANGES:

- A. A spreadsheet log of Cost Events will be maintained by the Contractor. This log will show the status of items that will possibly affect the cost/scope/time of the project from identification in the field through proposed change and final change order status. This log must include in column format:
 - 1. The Cost Event Number
 - 2. The Scope Item description
 - 3. The Change Order Request (COR) Number if applicable
 - 4. The Change Order (CO) number if applicable
 - 5. How the event is funded (allowance, contingency or cost to owner)
 - 6. The status of submittal and approval through the Architect and Owner
 - 7. Proposed change in schedule
 - 8. Notes
- B. Cost Events noted on the log will represent complete items of work. If additional items of work are identified to be portions of work to support or ensure another Cost Event items is complete; that original Cost Event item will be changed on the log to reflect the total effort, cost and schedule for that item as if the item were a separate project.

1.4 COST EVENT

- A. A Cost Event is the term used to identify some change in funds allocated from the owner or the contractor against a change in the scope or schedule. It can be a cost to the owner eventually as a CO or within the contractor's funds as redistribution on the Contractors Application for Payment G703, schedule of values. Both require prior written approval of the Cost Event, or of a COR and CO from the Owner.
- B. A Cost Event will be established for each proposed item affecting the allocation or increase of funds on the project. The Contractor will assign a number to the Cost Event.
- C. The Contractor will prepare the Cost Event form provided by the Owner (or another format as approved by the Project Manager in writing) for illustrating the costs associated with the

Cost Event. The same form will be used for the resulting Change Order Request (C) and Change Order (CO) if applicable.

- D. The Cost Events shown on the log will be reviewed in each OAC meeting.
- E. Cost Events that are determined by the Project Manager to be a redistribution of contractor funds will be submitted to the architect for review and approval and once signed then submitted to the Project Manager via e mail. The contractor can submit the Cost Event forms during the OAC meeting for signature by the architect and Project Manager as well. Once the document is signed by all parties, the contractor can redistribute the funds on the G703 Application for Payment and submit the form with the application.
- F. Cost Events that are determined by the Project Manager to be a cost increase to the owner will follow the requirements in 1.5 and 1.6 below.
- G. Cost Event will be reviewed by the Architect and Project Manager using the following criteria:
 - 1. Conformance with the contract
 - 2. Correctly completed Cost Event form
 - 3. Material, labor and equipment quantities and costs
 - 4. Requests for additional time
 - a. If rejected by the Architect or Owner, the Contractor will follow the instruction in the Contract Documents or immediately take action to obtain necessary revisions or corrections to the Cost Event.
- H. A Cost Event does not obligate the Owner to a change in the Contract Documents. If changes in the scope or schedule are made without a change in cost, a COR and CO can be used as noted below in 1.5 and 1.6, to identify changes that require the owner's approval.

1.5 POTENTIAL CHANGE ORDER

- A. Potential Change Order - When a Cost Event will affect one or more of the conditions in 1.4.4 above, the Contractor will prepare and submit a COR. The COR shall be prepared using the Owner's Cost Event form. The Contractor can use a cover page of their design provided it incorporates the required information noted on the Owner's Cost Event form.
- B. The Contractor will submit the COR to the Architect who will then review and reject or approve it. If approved without comment, the Architect will submit the COR to the Project Manager (PM). If the PM approves the COR without comment it will be returned to the Architect and Contractor.
 - 1. The COR will be reviewed by the Architect and Project Manager using the following criteria:
 - a. Conformance with the contract
 - b. Correctly completed Cost Event form
 - c. Material, labor and equipment quantities and costs
 - d. Requests for additional time
 - 2. Only when a COR is approved by the Project Manager will the COR be included

into a Change Order. The Contractor will assign a number to the COR that correlates to the Cost Event and will be tracked on the Cost Event Log.

- C. Each COR shall be a total cost for a stand-alone effort associated with the Cost Event. A COR shall include the full accounting for the task involved in the Cost Event. Additional items relating to, in support of, as a result of, dependent on or in a manner that can reasonably be associated as impacting or being impacted by the COR, shall be part of that COR.
- D. A COR can be for a deductive cost to the project, a reduction in time, a reduction in scope or any combination of reductions. A COR does not obligate the Owner to a change in the Contract Documents.

1.6 CHANGE ORDER

- A. Change Order - A Change Order (CO) will be created by the Contractor after the COR has been approved by the Project Manager and Architect. The CO shall be prepared using the Owner's Cost Event form. The Contractor can use a cover page of their design provided it incorporates the required information noted on the Owner's Cost Event form. The Contractor will assign a number to the CO that correlates to the COR and Cost Event and will be tracked on the Cost Event Log.
- B. A Change Order shall be for an increase or decrease in cost and shall contain any number of COR's.
- C. The Contractor will submit the CO to the Architect who will then review and reject or approve it. If approved without comment, the Architect will submit the CO to the Project Manager (PM). If the PM approves the CO without comment it will be signed by the Owner and returned to the Architect and Contractor. The CO will be reviewed by the Architect and Project Manager using the following criteria:
 - 1. Conformance with the contract
 - 2. Correctly completed Cost Event form
 - 3. Material, labor and equipment quantities and costs
 - 4. Requests for additional time
- D. A Change Order shall constitute the only legal agreement between the Owner and the Contractor for changes in the Work.
- E. Only when a CO is approved by the Owner will the CO be included into the Contractor's application for payment and not before.

1.7 AUTHORITY TO ISSUE CHANGES:

- A. The authority to order a change to a project under construction rests solely with the Project Manager or as noted in the Contract Documents.

1.8 AUTHORIZATION FOR CONSTRUCTION TO PROCEED:

- A. In order for a change in the Work to proceed, the Contractor shall;
1. Submit the Cost Event form electronically to the Architect and Project Manager with an explanation of the scope and reasons for the change; or
 2. Submit a full COR to the Architect and Program Manager with Cost Event form(s) attached, or
 3. Where urgency requires, the Contractor will notify the Architect and Project Manager in writing of the urgent nature of the request and a description of the scope in advance of the Cost Event form being submitted.
- B. The Architect and Project Manager will review the request and if approved shall reply in the body of an e mail or return the documentation signed with approval or both.

END OF SECTION 01 26 63

SECTION 01 29 73 SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SCHEDULE OF VALUES:

- A. General: Prepare a Schedule of Values (SOV) as required by the A201 General Conditions of the Contract (A201), in coordination with the preparation of applications for payment, progress reports and progress schedules. Provide the breakdown of the Guaranteed Maximum Price in the SOV as follows;
 - 1. For General Conditions Costs show a line item on the G703 Schedule of Values (SOV) and have a corresponding spread sheet attached identifying each cost associated with that line item with appropriately noted costs as required under the terms and conditions of the A201 for labor burden, truck allowance, living expenses, travel expenses, relocation expenses, etc., as required by the Contract Documents. There will not be retainage held on General Condition's costs.
 - 2. For Fee, show a line item on the G703 SOV. Retainage will be held on the Fee in accordance with the contract Documents.
 - 3. For allowances, show a line item for each on the G703 SOV. Each allowance noted for a specific trade (i.e. Electrical) will be placed on the G703 under the corresponding CSI code for that trade. These Allowances will be transferred into other line items in the SOV when allocated according to the Contract Document.
 - 4. For contingency, show a line item on the G703 SOV. Contingency will be transferred to other line items in the SOV in accordance with the Contract Documents.
 - 5. The Contractor will use the Construction Specifications Institute (CSI) format for scope identification numbering.
 - 6. Provide a cost line for each technical trade cost on the G703 SOV. Each trade cost shall be for the amount under contract for that particular trade and each specific sub-contractor or vendor in that particular trade (if more than one). Amounts not under contract with a particular contractor yet still allocable to that scope of work will be identified as in item 3 above and the A201.
 - 7. Change Orders will be listed separately and with appropriate breakdown of SOV components as required in the A201.
- B. Sub-Schedules: Where work is separated into phases which require separately phased occupancy by the Owner, provide sub-schedules of values correlated with each major phase of construction following the same terms as in 1.2.A.
- C. Material/Fabrication Values: For materials fabricated and not yet installed and otherwise meeting the terms and conditions for billing in the A201, bill for only the portion of costs associated with the fabrication, delivery and storage and not the installation provided the total cost including installation shall not exceed the original scheduled cost.
- D. Provide initial SOV to the Program manager for review in accordance with the A201.

- E. Provide the latest SOV each month with the Monthly Progress Report and for review in the OAC meeting.
- F. Only costs that have been incurred or been invoiced to the Contractor will be included as completed work in the SOV. The Contractor will bill the Owner each month for only those costs and not for costs anticipated or extrapolated for a future value.
- G. Unless otherwise required by the Program Manager in writing, the Contractor will provide the G703 SOV each month with the G702 Application for Payment in order to receive payment from the Owner.
- H. Update the G703 SOV in accordance with the Contract Documents for changes in allowances, contingencies, buy- out of contracts or identified savings otherwise in items that require changes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 29 73

SECTION 01 29 76

APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 PAYMENT REQUESTS:

- A. Payment Application Forms: AIA Document G702 unless approved by the Program Manager for Project Accounting in advance. The application for payment (G702) will include appropriate back up as described under the A201 General Conditions of the Contract (A201) and the specifications for Schedule of Values in these documents.
- B. Payment Application Submittal: Except as otherwise indicated or requested by the Owner in writing, the submittal for applications for payment (G702) shall be the same time each month and be consistent with previous applications.
- C. Lien Waiver: Each G702 shall be accompanied by a lien release or affidavit of lien releases received by the Contractor for all sub-contractors or suppliers who have contract values over \$500. The affidavit document when used shall be a spread sheet showing each Subcontractor, sub-subcontractor and supplier (all preceding being referred to as vendors) that has invoiced for payment to the Contractor and that has received payment from the Contractor under the terms and conditions of the Contract Documents. The Contractor will certify using a notary as to the exact payments received from the Owner, the exact payments made to the vendors and the status of the submittal and receipt of the corresponding lien waivers/ releases to and from those vendors for both conditional and unconditional lien waivers/ releases.
 - 1. Final close out documentation required under the Contract Documents shall include the unconditional lien waivers/ release forms accumulated by the Contractor up to and including the final payments made to the vendors. Depending on the timing of the final payment and collection of final unconditional lien waiver release forms, the Contractor will ensure that the Program Manager receives these signed documents within forty five (45) days of final payment.
- D. Waiver /Release Forms: Prior to the first G702, the Contractor shall submit blank affidavit and lien waiver/release forms to the Program Manager for prior written approval. Such forms shall comply with state law.
- E. Payment Application Times: The period of construction work covered by each payment request is to be one month unless otherwise approved in writing by the Program Manager.
- F. Application process: See also the A201. The Contractor will submit the G702 and supporting documentation to the Architect. The Architect will review and respond within seven (7) days to the Contractor and Program Manager with approved certificate or reasons for rejection. If approved, the

Architect will submit to the Owner's project management web site. The Program Manager will review and forward to the Owner for signature. Once approved, the Application for Payment will be processed by the Owner for payment.

- G. Application Preparation: Except as otherwise indicated, complete every entry provided for on the form, including notarization and execution by authorized persons.
- H. Failure by the Contractor to submit a proper Application for Payment: If the Contractor fails to submit a properly executed G702 and supporting information as required by the Contract Documents, Contractor shall not be entitled to payment by the Owner until such necessary information is provided correctly and completely. The Owner, Program Manager or Architect will provide to the Contractor notification as to the problems with an Application for Payment that does not meet the requirements of the Contract Documents. Where the Contractor has failed to submit a G702 properly over a period of two (2) months and is therefore refused payment for work going back three (3) months, the Owner shall direct the Contractor, at no cost to the Owner, to;
 - 1. escrow the funds required to make payment to the vendors; and
 - 2. notify the vendors of the circumstances; or
 - 3. remove the items on the G702 that are not in compliance for future correction; and
 - 4. re-submit the G702 as specifically required by the Owner for compliance.
- I. Along with Application for Payment submit substantiation of actual cost of work to the Owner. This shall include subcontractor payments, material invoices, payroll data, current general conditions costs, rental expenses, allowances, travel expenses, etc. These actual cost of work documents can be substantiated by the Contractor's software based project accounting forms (not project management software) for actual costs to date.
- J. Owner's GPO form: The Contractor will provide the completed Group Purchasing Organization (GPO) form with each Application for Payment.
- K. Payment of funds by the Owner will be predicated on the properly executed G702 and supporting documentation and the submittal of the monthly progress report, the properly completed GPO form and other terms and conditions of the Contract Documents.
- L. Where required by the Contract Documents, Applications for Payment for final billing will be preceded or accompanied by the required documents noted in the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

EXHIBIT "J.3" G702 – APPLICATION AND CERTIFICATION FOR PAYMENT

EXHIBIT "J.4" G703 - CONTINUATION SHEET

END OF SECTION 01 29 76

APPLICATION FOR PAYMENT

01 29 76 - 2

EXHIBIT “J.3”

G702 Application and Certification for Payment
RFP No. _____



AIA® Document G702® – 1992

Application and Certificate for Payment

TO OWNER: TCHD db/a JPS Health Network
1500 South Main Street
Fort Worth, Texas 76104

PROJECT:
FROM
CONTRACTOR: VIA
ARCHITECT:

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR:
CONTRACT DATE:
PROJECT NOS: / /
CONTRACTOR:
FIELD:
OTHER: ☐

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract, Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM \$0.00

2. NET CHANGE BY CHANGE ORDERS \$0.00

3. CONTRACT SUM TO DATE (Line 1 ± 2) \$0.00

4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) \$0.00

5. RETAINAGE:

a. 0 % of Completed Work

(Column D + E on G703)

b. 0 % of Stored Material

(Column F on G703)

Total Retainage (Lines 5a + 5b or Total in Column I of G703) \$0.00

6. TOTAL EARNED LESS RETAINAGE \$0.00

(Line 4 Less Line 5 Total)

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT \$0.00

(Line 6 from prior Certificate)

8. CURRENT PAYMENT DUE \$0.00

9. BALANCE TO FINISH, INCLUDING RETAINAGE

(Line 3 less Line 6) \$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$0.00	\$0.00
Total approved this Month	\$0.00	\$0.00
TOTALS	\$0.00	\$0.00
NET CHANGES by Change Order		\$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: _____

County of: _____

Subscribed and sworn to before

me this _____ day of _____

Notary Public:

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

EXHIBIT “J.4”

G703 Continuation Sheet

RFP No. _____



Continuation Sheet

ALIA Document, G703[®]-1992, Application and Certification for Payment, or G736CP-2009, Project Application and Project Certificate for Payment, Construction Manager as Advise Edition, containing Contractor's signed certification is attached.

In tabulations below, amounts are in US dollars.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: _____

APPLICATION DATE: _____

[illegible]

SECTION 01 31 15
COORDINATION DRAWINGS

1 - GENERAL

1.1 SUMMARY

- A. As an informational submittal, submit coordination drawings or electronically formatted designs thirty (30) days before installation of components.
- B. If using CADD or BIM, the plans and sections shall be drawn at a scale.
- C. Drawings will be developed by one firm with the input of the other trades and controlled by the General Contractor. The drawings will be done in either CAD or BIM based software.
- D. Clash detection meetings for coordination will be the responsibility of the General Contractor to facilitate. The Design team will be asked to participate after all known clash detection that can be corrected by the contractor has been corrected.
- E. Coordination drawings shall show the Project specific layout, required installation sequences, and locations of the following:
 - 1. Structure
 - 2. Duct work
 - 3. Mechanical components and equipment
 - 4. Plumbing fixtures and equipment
 - 5. Electrical raceways, large conduit and equipment
 - 6. Civil components where applicable
 - 7. Architectural components where applicable
 - 8. Fire Protection
 - 9. Mechanical Equipment HVAC Equipment
 - 10. Ductwork
 - 11. Fire, Smoke, Balance Dampers Fire and Smoke Partitions Lighting Fixtures
 - 12. Owner provided equipment as required for coordination
 - 13. Low voltage components by the Contractor or the Owner
- F. Submit one final set or electronic version in a format described of the drawings to the Architect/Engineer and one set of drawings to the Owner for approval.

1.2 DRAWINGS

- A. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable
 - 1. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - 2. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- G. Sheet Size: When printed for distribution to the Owner or Architect, ½ sized drawings no larger than 30 by 40 inches.
- H. Number of Copies: Submit electronic (pdf) version of each submittal. Architect will return pdf with comments if warranted.
- I. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 15

SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 MEETING COORDINATION:

- A. Contractor's Responsibility: schedule meetings, coordinate attendance, provide a written agenda, administrate the meeting and keep and distribute meeting minutes. Include for distribution the Architect, Program Manager, Owner, the Owner's project management web-site (obtain the address from the Program Manager) and as requested by the Program Manager.

1.3 PRE-CONSTRUCTION MEETING:

- A. Schedule the meeting within the first four (4) weeks of construction to include available sub-contractors and required representatives of the hospital.
- B. The meeting agenda shall include the following topics:
 - 1. Safety requirements
 - 2. ICRA requirements
 - 3. Pre-Construction requirements of the Owner's Policies and Procedures
 - 4. Training requirements
 - 5. Phases of the Work and the Schedule
 - 6. Staging requirements
 - 7. Access requirements
 - 8. Waste removal requirements
 - 9. Design elements
 - 10. Communication
 - 11. Document procedures
 - 12. Insurance requirements
 - 13. Reporting requirements
 - 14. Meeting requirements
 - 15. Close out requirements

1.4 PROGRESS MEETINGS WITH THE OWNER AND DESIGN TEAM:

- A. Weekly - Schedule meetings each week with the hospital staff. Each meeting will include discussions for safety, infection control, staging and logistics, progress, upcoming work, disruptions and shut-downs and items of concern or action items.
- B. Bi Weekly - Schedule every two (2) weeks for coordination. The first meeting will be as a review meeting with the architect on site and applicable engineers for review of the work in place. This meeting will also be a conference call meeting or as required, a teleconference meeting with the

Program Manager and necessary planners, engineers, designers and administrators of the Owner, Architect and Contractor. The second meeting will be for the Owner, Architect and Contractor (OAC) meeting on site with attendance by the Program Manager, necessary consultants, engineers, contractors, administrators and others for a comprehensive evaluation of the project. During one of the two meetings, the Architect and Contractor will review (with the Program Manager if in attendance) the application for payment by the Contractor.

- C. Prepare an agenda for the non OAC, bi-weekly meeting/call to include (subsequent meetings minutes can serve as the basis for consecutive meetings);
 - 1. Safety issues and compliance
 - 2. Infection Control issues and compliance
 - 3. Hospital Policies and Procedures compliance
 - 4. Staging, phasing and logistics issues or comments
 - 5. Previously completed work
 - 6. Look ahead schedule
 - 7. Cost events and overall project costs
 - 8. Requests for information
 - 9. Interruptions to building services and disruptions of business operations
 - 10. Submittals
 - 11. Action items and issues affecting the project
- D. Prepare an agenda inclusive of specific documents requested below for the OAC meeting to include (subsequent meetings minutes and monthly reports can serve as the basis for consecutive meetings);
 - 1. Safety issues and compliance
 - 2. Infection Control issues and compliance
 - 3. Hospital Policies and Procedures compliance
 - 4. Staging, phasing and logistics issues or comments
 - 5. Previously completed work
 - 6. Labor issues
 - 7. Look ahead schedule
 - 8. OFE delivery schedule
 - 9. Inspection schedule
 - 10. Interruptions to building services and disruptions of business operations
 - 11. Overall critical path schedule
 - 12. Cost events and overall project costs
 - 13. Requests for information
 - 14. Submittals
 - 15. Action items and issues affecting the project
 - 16. Punch list items
 - 17. Lessons learned
 - 18. Systems verification sheets in progress
- E. For meetings where pay applications are being reviewed, the discussions should include application review with field observations by the architect and engineers.

1.5 PRE-INSTALLATION AND START- UP MEETINGS:

- A. Conduct a pre-installation meeting for structural systems, site work, exterior utilities, exterior

envelope, major medical equipment installations, low voltage building systems including security hardware, finishes and casework and interior mechanical, electrical, plumbing and fire suppression systems. Each meeting shall include at a minimum, discussions for; safety, coordination, impact to existing building systems and operations, schedule, staging, documentation, reporting, communication, design and procedures for changes. The Contractor shall invite the Architect, Program Manager and Owner's planners or consultants where applicable. The Contractor will keep meeting minutes and provide them upon request to the Program Manager.

- B. Conduct a separate meeting for major system start up to include utilities, mechanical units (air handlers, chillers, boilers, cooling towers, DX units de-aerators, steam generators), building system controls, fire suppression and fire alarm, electrical gear and generators. Prepare a check list based on start-up procedures provide by the manufacturer and referenced against the specifications. Invite the Architect, Program Manager and hospital staff where applicable.

1.6 PRE-TEST AND BALANCE and SYSTEMS VERIFICATION MEETING:

- A. Conduct a meeting to discuss test and balance and Systems Verification with representatives of the Program Manager, Owner's Engineering Verification Consultant (if required by PM), Architect, Engineers, General Contractor and mechanical, electrical and temperature control subcontractors to discuss the requirements for the work.
- B. Review responsibilities and schedule requirements of the Subcontractors and the test and balance contractor.

1.7 COORDINATION MEETING

- A. Conduct meetings as required to incorporate the building systems into the planned physical space as shown on the Drawings. Invite the Architect, Program Manager and relevant subcontractors.
- B. Utilize current design technology to produce drawings illustrating the locations for each system within a defined space and illustrating clashes between systems. Continue meetings until all conflicts or clashes are either reduced or denoted for field clarification.
- C. The Contractor will be able to demonstrate on the drawings where the design deviates from the original Drawings. The Contractor will be able to illustrate on the drawings where building maintenance access will be maintained for areas requiring access. The Contractor will demonstrate that ceiling heights have been maintained as originally designed.
- D. Provide digital copies of the drawings to the Architect for review and approval prior to installation.
- E. Create Coordination Drawing per specifications.

1.8 OTHER MEETINGS:

- A. Subcontractor and Vendor Meeting - Conduct weekly meetings with sub-contractors and vendors for site safety and coordination.
- B. Safety and Training Meetings – Conduct informational training meeting to initiate all persons who will work inside an operational hospital or in a building adjacent to the hospital with the requirements provide by the Owner and Contractor. Include the safety and other training information provided by

the Owner that is pertinent to the environment. Create a system of acknowledgment and identification for persons that have been trained. At a minimum, the training shall include the hospital's policies and procedures for code alerts, job site safety, lock out and tag out, hot work, notifications, informational patient privacy, infection control policies and the Contractors own safety program.

- C. Preventative Maintenance Meeting - Conduct a meeting to discuss the Owner's Preventative Maintenance (PM) Program. Assist the Owner with preparation of the PM program spread sheet by providing the information required.

1.9 CLOSE –OUT MEETING:

- A. Conduct a meeting for each phase of completion, inspection and close out.
- B. Include where applicable the Architect, Program Manager, hospital staff, vendors providing transition planning and relocation services and equipment planning and procurement.
- C. The agenda will include the requirements in order to meet the expectations of and/or sequence for:
 - 1. The Contract Documents including the relevant spec sections,
 - 2. Scheduling the One year Walk Through with the Owner, Architect and Program Manager,
 - 3. The authority having jurisdiction (AHJ),
 - 4. Types and dates for inspections,
 - 5. The final OFE installation,
 - 6. The construction and terminal cleaning,
 - 7. The relocation of patients and supplies where applicable,
 - 8. Punch list procedures and inspections,
 - 9. Date of occupancy and use,
 - 10. Date for substantial completion,
 - 11. Final occupancy notification from the AHJ,
 - 12. Verification and commissioning,
 - 13. System training,
 - 14. Demobilization from phase or site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 19

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 COORDINATION:

- A. Coordinate the procedural timing and the listing (naming and sequencing) of reports/activities required by provisions of this section and other sections, to afford consistency and logical coordination between submitted reports or lists. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to entities involved in the work including Architect/Engineer and Owner. In particular, provide close coordination of progress schedule, equipment, delivery schedule, and schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

1.3 PROGRESS SCHEDULE:

- A. The Contractor's Monthly application for payment is paid dependent on the Owner receiving the Monthly Progress Report with the current Progress Schedule included.
- B. The Contractor shall upon notice to proceed and not more than ten (10) days thereafter, develop and submit a Critical Path Schedule (per phase where applicable) using a nationally recognized scheduling software program. Include items below at a minimum.
 - 1. Mobilization and set up at the site,
 - 2. All Construction related activities and major material acquisition dates,
 - 3. Major medical equipment deliveries,
 - 4. Furniture delivery,
 - 5. Art installation,
 - 6. Signs installation,
 - 7. Final and terminal cleaning,
 - 8. Inspections,
 - 9. Owner occupancy,
 - 10. Constructing of infection control barriers and other temporary measures,
 - 11. Training of installed systems,
 - 12. Verification program,
 - 13. Commissioning program,
 - 14. Punch list creation and work.
 - i. The Contractor will contact the Owner's Planners to ensure compliance with the

schedule with such frequency to avoid delays in the delivery of furniture, art, signs, medical equipment, IT Systems and specialties.

- C. Schedule: The critical path/progress schedule shall indicate (by stage-coded symbols) a time bar for each major category or unit of work to be performed at site, and including minor units which are, involved in overall sequencing of the Work. Arrange schedule to graphically show major sequences required in intermeshing of Work, and to show how Substantial Completion is scheduled to allow for Architect's/Engineer's procedure for certification thereto. Prepare and maintain schedule on sufficiently wide sheet or series of sheets, of stable transparency or other reproducible stock, to show required data clearly for entire Construction Time, and to permit reproduction for required distribution.
 - D. Phasing: Arrange schedule with notations to show how sequence of work is affected by requirements for phased completion, work by separate contractors, work by Owner, pre-purchased materials, coordination with existing work, limitations of continued occupancies, non-interruptible services, partial occupancy prior to substantial completion, site restrictions, provisions for future work, seasonal variations, environmental control, and similar provisions of total project. Refer to other sections of Division 1 and other Contract Documents for requirements.
 - E. Individual Work Stages: Using uniform targeted symbols and bars, show significant stages for each category or unit of work, including subcontract award, submittals, purchases, mockups, fabricating, sample testing, deliveries, installation, testing, adjusting, curing, start up and placement into final use and operation. Where fabrication or installation of major units of work require (3) months and longer, show estimated percentage of completion markers at 10 percent increments. As each unit of work progresses, mark each long bar with a contrasting mark (at 10 percent increments) to show actual percentage of completion.
 - F. Area Separations: Arrange the schedule with an individual time bar for each major area of construction, of each major category or unit of work where it must be sequenced or intermeshed with other work as needed for structural completion, permanent space enclosure, and completion of mechanical/electrical work for overall work in that area. Except as otherwise indicated, a "major area" is defined for purpose of this article to mean a story of construction, phase of the work, portion of a floor, or similar separation.
 - G. Distribution: Following initial submittal to and response by Architect/Engineer and Program Manager, distribute the progress schedule to Architect, Program Manager, Owner, Owner's consultants and planners, principal subcontractors and suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. Post copies in project meeting rooms and field (temporary) offices. Distribute through the monthly report to the Owner, Program Manager, Architect, vendors, sub-contractors, Owner's planners and consultants. If requested by the Owner's planner, distribute separately from the monthly report.
 - H. Updating: Revise and update the "look ahead" schedule weekly and the critical path schedule monthly.
- 1.4 FORECAST (LOOK AHEAD) SCHEDULE:
- A. The Contractor will prepare a Forecast or "look ahead" schedule for each one, two or three weeks of activity after the project has sufficiently started construction activities, but no more than one month after the initial start date.

- B. The Forecast schedule will include activities in adequate detail for demonstrating what activities will be occurring in the upcoming time period denoted. Identify shut downs, disruptions or other impediments to the existing operations of the hospital where they are expected and so noted on the Shut Down and Disruption Log.

1.5 SUBMITTAL SCHEDULE:

- A. General: Immediately following development and acceptance of fully developed progress schedule, prepare a complete schedule of work-related submittals. Submit within ten (10) days of date required for establishment of progress schedule. Correlate submittal schedule with listing of principal subcontractors, as required by the General Conditions, and with the "Listing of Products" or "Procurement Schedule" as specified in "Products and Substitutions" sections and elsewhere in Contract Documents.
- B. Form: Prepare schedule in chronological sequence of "First Submittals". Show category of submittal, name of subcontractor, generic description of work covered, related section numbers, activity or event number on progress schedule, schedule date for first submission, and blank columns for actual date of submittal, re-submittal, and final release or approval by Architect.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 32 16

SECTION 01 32 26

PROGRESS REPORTING

PART 1 - GENERAL

1.2 RELATED DOCUMENTS

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

1.3 COORDINATION

- A. Coordinate both the procedural timing and the listing (naming and sequencing) of reports/activities required by provisions of this section and other sections, to afford consistency and logical coordination between submitted reports or lists. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to entities involved in the work including Architect/Engineer and Program Manager. In particular, provide close coordination of progress schedule, equip. delivery schedule, schedule of values, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

1.4 REPORTS

- A. Project Contact Directory: Prepare a contact list of the persons including names, numbers and e mail in the following categories: Hospital Key Personnel (Administrator, CNO, DPO, Safety Officer); CHS Senior Director; CHS Interior Designer; CHS Equipment Planner; Design Team (architect, lead engineers per discipline, testing agent(s)); Contractor's key team members; sub-contractor key personnel per trade; medical equipment, furniture, signs, art persons. This list will be published and submitted to the Owner's web based reporting location and titled "Project Contact Directory". Update this list periodically as names change and re submit.
- B. Daily Reports: There is no requirement for a daily report but it is recommended that the contractor keep one.
- C. Weekly Reports: Prepare a weekly report. Distribute the report to the Architect, Owner, Program Manager and submit in electronic version only to the Owner's project web site (obtain address from the Program Manager). Include the following information:
 - 1. Project Name
 - 2. Date
 - 3. Distribution list
 - 4. Current contract total
 - 5. Current milestone dates
 - 6. Safety/ICRA/Logistical or other compliance issues and updates,
 - 7. Activities completed in the past week,
 - 8. Upcoming activities for the following week,

9. Action items or items requiring the attention of the Program Manager and Architect,
 10. Photographs if necessary to illustrate conditions requiring the attention of the Program Manager and Architect,
 11. Cost events that have become apparent in that week,
 12. Schedule events that have become apparent in the last week, and
 13. A Forecast schedule attached separately.
- D. Monthly Reports: Prepare a monthly progress report. Distribute in electronic version only to the Architect, Owner, Program Manager, the Owner's planners and consultants and additional persons as directed by the Program Manager. Send a copy to the Owner's project web site (the same address will apply to all reports and meeting minutes). Update the report contents each month or state in the summary any items that are not changed from the previous report. Include in the report only the following information:
1. Cover page
 2. Summary page including
 - a. Facility Name
 - b. Project Name
 - c. Date
 - d. Report number
 - e. Schedule summary of major dates
 - f. Starting cost, changes to cost or contingency
 - g. Any action items requiring immediate attention
 3. Costs Event Log with contingency and allowance starting and remaining budgets
 4. RFI log
 5. Submittal Log
 6. Look ahead schedule
 7. Critical Path schedule
 8. Punch list log
 9. Action Items list
 10. Shut down/Service/Operations disruption schedule
 11. Lessons learned list
 12. A list of recycled materials and other sustainability methods employed during the period
 13. Photographs
 14. Cash flow projection chart current to that month
 15. A copy of the latest payment application cover page

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 32 26

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. The types of submittal requirements specified in this section include shop drawings, product data, samples and miscellaneous work-related submittals. Individual submittal requirements are specified in applicable sections for each unit of work. Refer to other Division 1 sections and other Contract Documents for requirements of administrative submittals.
- B. Definitions: Work-related submittals of this section are categorized for convenience as follows
 1. Shop drawings include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.
 2. Product data include standard printed information on materials, products and systems; not specially prepared for this project, other than the designation of selections from among available choices printed therein.
 3. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.
 4. Mock-ups are a special form of samples, which are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals. Refer to Section 01 43 39 for information on Mock Up construction requirements.
- C. Action Submittals: Written and graphic information that requires Architect's responsive action. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- D. Informational Submittals: Written information that does not require Architect's responsive action inclusive of Delegated Design Submittals. Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
- E. Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

1.2 GENERAL SUBMITTAL REQUIREMENTS

- A. Scheduling: Where appropriate in required administrative submittals (listing of products, manufacturers, suppliers and subcontractors, and in job progress schedule), show principal

work-related submittals and time schedules for coordination of submittal activity with related work in each instance. Indicate submittal dates and review periods for major items of work on the project schedule.

- B. Listing: Prepare a separate submittal log organized by related specification section number sequence, showing principal work-related submittals and their initial submittal dates as required for coordination of the work. Submit listing within (30) days of date of commencement of the work. The submittal log shall contain the following minimum information
 - 1. Project Name, Location, Architect & Project No.
 - 2. Specification Section No.
 - 3. Description of submittal
 - 4. Manufacturer
 - 5. Required submittal date for coordination of work
 - 6. Date received
 - 7. Date transmitted to Architect
 - 8. Date returned
 - 9. Status of Review
 - 10. Remarks
- C. All information including shop drawings, product data and samples shall be identified in the log.
- D. At the end of each month, the Contractor shall make copies of the submittal log and distribute to the Owner and Architect. Any items critically needed for the progress of the work should be identified.
- E. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect review with another.
- F. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- G. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, Subcontractor, submittal name, specification section number, and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for Architect "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through Contractor's office and those submittals not reviewed and approved by Contractor, will be returned by Architect's "without action". Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- H. Transmittal Form: A format at the discretion of the Architect or the AIA Form G810 in electronic and hard copy or at the discretion of the Architect. To the greatest extent possible, format submittals electronically, i.e., submit in pdf format.
- I. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- J. Use for Construction: Use only final submittals with mark indicating "Approved," "Accepted," "Approved as Noted," or "Accepted as Noted" issued by Architect.

1.3 SPECIFIC-CATEGORY SUBMITTAL REQUIREMENTS

- A. General: Except as otherwise indicated in individual work sections, comply with requirements specified herein for each indicated category of submittal. Provide and process intermediate submittals, where required between initial and final, similar to initial submittals.
- B. Owner's Records (Informational Submittal): The Contractor shall maintain a pdf of each item in his file for delivery to the Owner's user at the completion of the project. The second package shall include a pdf of shop drawings and product data submittals and shall include an index in the transmittal.
- C. Shop Drawings (Action Submittal): Provide newly-prepared information, in pdf format, with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards, and special coordination requirements. Do not allow shop drawing distribution without appropriate final "Action" markings by Architect to be used in connection with the Work.
 - 1. Submittals: Provide prints in pdf format. Contractor shall obtain pdfs, marked "approved" for maintenance manuals, record documents, Owner's records, and other parties requiring copies.
- D. Product Data (Action Submittal): Collect required data into one submittal for each unit of work or system; and mark each pdf to show which choices and options are applicable to project. Include manufacturer's standard compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements. Maintain one (1) hard copy set of product data (for each submittal) at project site, available for reference by Architect/Engineer and others.
 - 1. Submittals: Do not submit products data, or allow its use on the project, until compliance with requirements of Contract Documents has been confirmed by Contractor. Submit electronically in pdf format. The Architect shall mark up and return pdf to Contractor. The Contractor shall retain pdfs for Owner's records, and distribute others to parties involved.
 - 2. Provide a pdf-type submittal where required (or desired by Contractor) for selection of options by Architect/Engineer.
 - 3. Installer's Copy: Do not proceed with installation of materials, products or systems until final pdf of applicable product data is in possession of Installer.
- E. Samples (Action Submittal): Provide units identical with final condition of proposed materials or products for the Work. Include "range" samples (not less than three units) where unavoidable variations must be expected, and described or identify variations between units of each set. Provide full set of optional samples where Owner's selection is required. Prepare samples to match Owner's sample where so indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Architect and Owner. Samples must be submitted within thirty (30) days of Notice to Proceed.
 - 1. Submittal: At Contractor's option, provide preliminary submittal of a single set of samples for A/E's review and "Action". Otherwise, initial submittal is final submittal unless returned with "Action" which must be resubmitted. Submit two (2) sets of samples in final submittal; one set will be returned.
 - 2. Quality Control Set: Maintain returned final set of samples at project site, in suitable condition and available for quality control comparisons by Architect and by others.

- F. Mock-Ups (Action Submittal): See Mock Up Specifications.
- G. Inspection and Test Reports (Informational Submittal): Classify each as either "shop drawing" or "product data", depending upon whether report is uniquely prepared for project or a standard publication; process accordingly.
- H. Warranties (Informational Submittal): Refer to "Products" section for specific general requirements on warranties, product/workmanship bonds, and maintenance agreements. In addition to copies desired for Contractor's use, furnish 2 executed copies. (Furnish four (4) copies when required to be included in maintenance manual).
- I. Survey Data (Informational Submittal): Refer to "procedures" section for specific general requirements on property surveys, field measurements, quantitative records of actual work, damage surveys, photographs and similar data required by individual work sections of these specifications. None of specified copies will be returned.
 - 1. Survey Copies: Furnish copies for close out documents in the format requested in that specification.
 - 2. Records of Actual Work: See Specification for Record Documents.
- J. Closeout Submittals (Informational Submittal): Refer to individual work sections and to other Specification sections.
 - 1. Record Document Copies: Furnish one set according to Section 01 78 39.
 - 2. Maintenance/Operating Manuals: Comply with Section 01 78 23.
 - 3. Materials and Tools: Refer to individual work sections for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.
- K. General Distribution: Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to Subcontractors, suppliers, fabricators, installers, governing authorities and other as necessary for proper performance of the work. Include such additional copies in transmittal to Architect/Engineer where required to receive "Action" marking before final distribution. Record distributions on transmittal forms.
 - 1. Other Informational Submittals may include one or more from the following list
 - 2. Coordination Drawings
 - 3. Qualification Data
 - 4. Certificates regarding welders, installers, manufacturers, products, and materials,
 - 5. Reports such as material and product test reports, research/evaluation reports, preconstruction test reports, compatibility test reports, and field test reports.
 - 6. Maintenance data and design data.
 - 7. Manufacturer's instructions and field reports.
 - 8. Insurance certificates and bonds.
 - 9. Construction photographs.

1.4 DELEGATED DESIGN

- 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.

- B. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- C. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, 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 in the state in which the Work is performed.
- D. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.5 ACTION OF SUBMITTALS

- A. Contractor's Actions: 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 Program Manager. 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.
- B. Architect's action: Where action and return is required or requested, Architect will review each submittal, mark with "Action", and return. Where submittal must be held for coordination, Contractor will be so advised by Architect without delay.
- C. Final Unrestricted Release: Work may proceed, provided it complies with Contract Documents, when submittal is returned with the following: "Approved" or "Accepted".
- D. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following: "Approved as Noted" or "Accepted as Noted".
- E. Returned for Resubmittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking or unmarked submittals where a marking is required) to be used in connection with performance of the Work: "Disapproved, Resubmit" or "Not Accepted, Resubmit".
- F. Other Action: Where submittal is returned for other reasons, with Architect/Engineer's explanation included, it will be marked as follows: "No Action".
- G. Processing Time: Allow in every case a minimum of fourteen (14) calendar days 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.
- H. Initial Review: Allow fourteen (14) calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

- I. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
- J. Resubmittal Review: Allow fourteen (14) calendar days for review of each resubmittal.

1.6 SUBMITTAL SCHEDULE

- 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 additional time for handling and reviewing submittals required by those corrections.
- B. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
- C. 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.
- D. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
- E. Format: Arrange the following information in a tabular format
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category: Action; informational.
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.
 - 7. Scheduled date of fabrication.
 - 8. Scheduled dates for purchasing.
 - 9. Scheduled dates for installation.
 - 10. Activity or event number.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 33 00

SECTION 01 35 10
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:

- 1. Products and installation for patching and extending Work within construction areas of existing facilities.
- 2. Providing transition and adjustments.
- 3. Repair of damaged surfaces and finishes.

1.3 OCCUPANCY, ACCESS, AND PROTECTION

- A. Entire facility will be occupied during progress of construction for conduct of normal operations. Phase Work in accordance with Section 01 10 00.
- B. Normal business hours for facility are generally from 8:00 AM through 5:00 PM, seven days a week.
 - 1. Patient Areas of Medical Care Facilities: 24 hours per day, 7 days a week.
- C. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage. Perform work not to interfere with operations of occupied areas.
- D. Existing facilities will remain in full operation during execution of this Work. Exercise every precaution to ensure safety and protection for existing facilities, occupants, merchandise, pedestrians, and vehicles.
 - 1. Maintain safe access and egress at all times for occupants, pedestrians, and vehicles.
 - 2. Provide protection to prevent damage to facilities, merchandise, and vehicles from dust, water, weather, and other similar harmful elements. Refer to Section 01 50 00 - Construction Facilities and Controls for additional requirements.
 - 3. Maintain exiting from facilities to provide safe passage complying with applicable codes.

1.4 SCHEDULING OF WORK

- A. Make arrangements with Owner and schedule Work to avoid interference with normal operations of occupied areas. Submit schedule and summary of applicable Work within occupied areas and obtain Owner approval not less than two days prior to commencement of such Work.
 - 1. Requests for use of certain existing loading docks, passage ways, and other similar spaces within areas outside limits of construction operations will be limited to day-by-day basis and must be approved in advance by Owner.
- B. Coordinate access and scheduling of Work within tenant areas with Owner.

1.5 TORCH-CUTTING AND WELDING PROCEDURES

- A. Notify Owner in advance of torch-cutting and welding operations performed within occupied areas; obtain approval prior to proceeding with such operations.

1. Neither open-flame torch-cutting, welding or arc-welding are allowed without having secured appropriate permit from Fire Marshal or authority having jurisdiction.
 2. Keep portable fire extinguisher of appropriate class within reach during welding or torch-cutting operations.
 3. Screen arc-welding from vision of passersby.
- B. Maintain a "Fire Watch" for minimum of 60 minutes after completion of each torch-cutting and welding operation.

1.6 UTILITY SERVICE OUTAGES

- A. Keep utility and service outages to minimum and perform only after written approval of Owner is received.
1. Requests for outages will not be considered unless they include an identification of areas which will be affected by proposed outage.
 2. Schedule outages for times other than normal business hours.
 3. Make requests for outages minimum of five calendar days in advance of proposed outage.
- B. Contractor: Responsible for investigating utility and service lines to determine effect of outage upon building operations outside of limit of operations. Obtain approval in advance from Owner to execute investigations.
- C. Refer to Section 01 73 29 for other requirements.

1.7 KEYS

- A. When necessary to perform Work, Owner will issue keys to existing mechanical/electrical equipment spaces.
- B. Return keys at end of each work day; request keys on succeeding days, if necessary.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type and Quality of Existing Products: Use products or types of construction that exist in structure, as needed to patch, extend, or match existing Work.
1. Generally, Contract Documents do not define products or standards of workmanship present in existing construction.
 2. Determine by inspecting and testing products where necessary, referring to existing work as quality standard.
- B. New Materials: Comply with Specifications for each product involved.
1. Match existing products and work for patching existing work.
- C. Salvaged Materials: Salvage sufficient quantities of cut or removed material to replace damaged Work of existing construction, when material is not readily obtainable on current market.
1. Store salvaged items in dry, secure place on site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with provision of Section 01 43 00.
1. Verify that areas are ready for alteration and remodeling.

- B. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - 1. Prior to commencing work, carefully compare and check Contract Documents for discrepancies in locations or elevations of work to be executed.
 - 2. Refer discrepancies among Drawings and existing conditions to Architect for adjustment before work affected is performed.

3.2 PREPARATION

- A. Cut, move, or remove items as necessary for access to alteration and renovation Work.
 - 1. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, deteriorated masonry and concrete, and other deteriorated materials. Replace materials as specified for finished Work.
 - 2. Remove debris and abandoned items from area and from concealed spaces.
- B. Cutting and Removal: Perform cutting and removal work to remove minimum necessary, and in manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster, or metals by methods to terminate surfaces in straight line at natural point of division.
- C. Prepare surface and remove surface finishes as necessary to provide for proper installation of new materials and finishes.
- D. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.
- E. Provide temporary barriers and closures to control operations to prevent spread of dust to occupied portions of building; refer to Section 01 50 00.

3.3 INSTALLATION

- A. Coordinate Work of alterations and renovations to expedite completion and to accommodate Owner occupancy.
- B. Remove, cut, and patch Work in manner to minimize damage and to provide means of restoring products and finishes to specified condition.
 - 1. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
- C. Install products as specified in individual Specification sections.
- D. Where new Work abuts or aligns with existing, perform smooth and even transition to match existing adjacent surface in texture and appearance.
 - 1. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and request instructions from Architect as to method of making transition.

3.4 ADJUSTMENTS

- A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth plane without breaks, steps, or soffits.
- B. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
- C. Fit Work at penetrations of surfaces as specified in Section 01 73 29.
- D. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to application of finishes.

3.5 FINISHES

- A. Finish new surfaces as specified in individual Specification sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.6 CLEANING

- A. Comply with Section 01 77 00. Thoroughly clean areas and spaces affected by Work. Completely remove paint, mortar, oils, putty and items of similar nature.
- B. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

END OF SECTION 01 35 10

SECTION 01 35 23

OWNER SAFETY REQUIREMENTS

ADD JPS FORMS

ILSM POLICY (FORMS)

SAFETY PROGRAM

METHOD OF PROCEDURE (MOP) FORM

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS:

- A. This Section specifies minimum expectations and requirement the Contractor shall administer on the project. Nothing in this section is intended to limit types and amounts of temporary work required, and no omissions from this section will be recognized as an indication by the Owner, program Manager or Architect that such temporary activity is not required for successful completion of the work and compliance with requirements of Contract Documents.
- B. The Facility must maintain a safe environment for its patients and staff and must maintain Interim Life Safety Measures (ILSM) at all times during operations where disruptions to the basic life safety measures occur. The ILSM are intended to provide a level of life safety comparable to that described in latest adopted edition of the Life Safety Code (NFPA 101).
- C. The Contractor is required to know, understand and follow the facility required OSHA, NFPA, ASHE and CMMS safety and ILSM requirements.

1.2 SUBMITTALS:

- A. If required by the Program Manager, the Contractor will complete the form provided by the facility as an ILSM check list. In instances where the Contractor is not required to complete the form, the facility representative will complete the form and request the Contractor provide assistance as needed.
- B. Prior to the start of Construction, the Contractor shall complete the PRE-CONSTRUCTION SAFETY AGREEMENT and training, and sign the appropriate documents provided by the facility representative. The documents are included in the facility Environment of Care Manual for Policies and Procedures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MINIMUM SAFETY MEASURES shall include no less than the following items:

- A. Keep exits and exit corridors clear and unobstructed at all times.
- B. Maintain a clean work environment free of debris in pathways during construction activities.

- C. Clean the work environment regularly using designated labor.
- D. For areas outside the immediate work environment where person can exist or enter the work area; establish a cleaning schedule and post that schedule outside of the opening. Mark off the schedule at regular intervals when the appropriate cleaning has taken place including sweeping, removal of walk off sticky mats, vacuuming and wiping down of surfaces.
- E. Review with Owner, the Owner's Pre Construction Safety Agreement and required training for all personnel working inside the hospital for ICRA, ILSM and HIPAA requirements.
- F. Establish a training policy for all sub-contractors to become trained before entering the work site for the first time.
- G. Establish a system of identifying to the Owner all personnel trained to be on site.
- H. Review and implement the use of Owner provided compliance documents for items to include: Lock out tag out, Confined space and hot work permits.
- I. When exiting paths need to be changed or modified in any way, perform modifications only with the prior written approval of the Owner.
- J. Maintain free and unobstructed access to emergency department/services and for emergency forces.
- K. When a specific construction task must be performed in an exit corridor at no time may the clear width be reduced to less than 1/2 corridor width or 4'-0" whichever is greater.
- L. When normal access and egress routes are affected by construction, safe alternate routes will be developed and approved by the Owner.
- M. Identify temporary access and egress routes with professionally painted signs and provide signs restricting access to the construction area.
- N. Provide temporary lighted exit signs where lighted exit sign would be required by Code.
- O. Remove combustible debris from the work site at the end of each work shift.
- P. Separate work areas from the rest of the building with barriers of noncombustible materials. Provide clean, smooth surfaces on barriers.
- Q. Barriers shall be existing construction, temporary dust proof partition and when approved by the Owner, Program manager and Architect fire retardant tarps with UL label and flame spread of 15 or less.
- R. Protect openings in barriers with solid core wood or hollow metal doors with closers as appropriate to the rating of the walls where barriers are replacing or extending.
- S. Properly seal penetrations of fire and smoke walls, and floor slabs at the end of each work shift.
- T. Provide adequate support for ceiling mounted equipment, fixtures, devices, etc. which will remain in

area where ceiling grid is being removed.

- U. Replace ceiling tiles in occupied areas at the end of each work shift.
- V. Obtain advance written approval of the Safety Director prior to use of flammable liquids.
- W. Limit the supply of flammable liquids on the job site to one day supply. Do not store additional flammable liquids in the hospital.
- X. Limit the supply of compressed gas cylinders on the job site to one day supply. Do not store additional gas cylinders in the hospital.
- Y. Chain compressed gas cylinders to a wall or store in an approved cart.
- Z. Obtain appropriate permits from the authority having jurisdiction prior to starting welding, cutting, and the use of flame.
- AA. Provide appropriate types of portable fire extinguishers and make present and accessible at all times in each work area at a designated location such as the plan table. Provide an additional fire extinguisher and make present at each location of welding and cutting with an open flame.
- BB. Provide Contractors personnel who work in the area with training in the use of portable fire extinguishing equipment.
- CC. Until completion of the construction project, keep combustible storage in the area of the job site at the level approved by the Owner.
- DD. Before modification of the fire alarm system, notify and obtain written approval from the Hospital Administrator and the Director of Plant Operations.
- EE. Provide equivalent, temporary replacement for impaired fire systems. Test and inspect temporary systems.
- FF. In renovation and refurbishment areas where dust producing operation would produce false alarms, following consultation with the Owner, cover and uncover the smoke detectors at the end of each day's work.
- GG. Strictly enforce a no smoking policy at work sites, observing hospital smoking policy, and prohibiting construction personnel from smoking in or adjacent to construction areas.

END OF SECTION 01 35 23

JPS Health Network Construction, Renovation and Maintenance Activity Safety Policy



Updated 06/07/2021

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1.0 Scope

Welcome to JPS Health Network. The scope of this policy is to provide guidelines and instructions for all contractors/vendors performing construction activities within the JPS Health Network, to abide by, for the protection of patients and families, staff, and contractor personnel.

All contractors are responsible for facilitating the orientation of all personnel prior to performing work within the premises of the JPS Health Network. See **APPENDIX A – JPS Emergency Contact List** for a comprehensive list of JPS personnel with job titles for your use in the event of an emergency.

2.0 Introduction

Contractors and subcontractors performing work at the JPS Health Network are required to follow all local, state, and federal rules and regulations concerning the health and welfare of patients, staff, employees, as well as the general public.

Prior to all construction and renovation projects, a Pre-Construction Risk Assessment (PCRA), Infection Control Risk Assessment (ICRA), and the requirement for Interim Life Safety Measures (ILSM) will be assessed. **The results of these assessments must be posted at your jobsite for the duration of the project.** Contact your project manager immediately if one or more of these required postings have not been obtained.

While working on the premises of the JPS Health Network, everyone is a safety officer. If a worker observes any unsafe or potentially unsafe condition, which may pose a threat to the health or safety of themselves or others, he or she must immediately make an attempt to stop the work and inform the construction project manager assigned to the project.

3.0 Safety and Health Objectives

Contractors working at JPS Health Network must plan to achieve a safe workplace through the following:

- ✓ Using a competent safety person to oversee operations
- ✓ Utilizing a site-specific safety plan
- ✓ Continually making job site safety inspections
- ✓ Enforcing the use of safety equipment
- ✓ Providing on-going safety training
- ✓ Complying with all applicable safety and health requirements, including but not limited to, those prescribed within the PCRA, ICRA, and ILSM Assessment.
- ✓ Supplementing your safety plans and policies with the JPS Safety Rules (listed below).

4.0 Safety Rules

ALL OF JPS HEALTH NETWORK'S SAFETY RULES MUST BE OBEYED. FAILURE TO DO SO BY ANY CONTRACTOR'S EMPLOYEE WILL RESULT IN A DELAY OF WORK AND POSSIBLE DISMISSAL OF PERSONNEL FROM THE PREMISES.

1. Keep your mind on your work at all times. No horseplay on the job. Injury or removal from the job or both can be the result.
2. No profanity or explicit natured clothing or apparel allow on JPS property.
3. The use of cell phones and/or radios is prohibited while working.
4. Personal safety equipment must be worn as prescribed for each job task, including but not limited to safety glasses, hard hats, gloves, safety shoes, fall protection, safety vests, etc.
5. Precautions necessary to prevent sunburn and to protect against burns from hot materials must be taken.
6. The SDS's for all materials must be maintained on the site and utilized in the event of an incident or spill.
7. Watch where you are walking and do not run.
8. The use of illegal drugs or alcohol or being under the influence of the same on the project shall be cause for immediate removal from the premises.
9. Workplace violence will not be tolerated and will result in immediate removal from the premises.
10. Do not distract the attention of fellow workers. Do not engage in any act which would endanger another employee.
11. Coordinate with the JPS project manager on the use of sanitation facilities. Defacing or damaging these facilities is forbidden and will result in fiscal consequences.
12. Hand washing sinks are not to be used for construction or renovation purposes.
13. Maintain a clean work environment free from debris and materials that could pose tripping hazards, increase fire risk, infection control risk, etc.
14. Never move an injured person unless it is absolutely necessary in procuring their health and safety. Further injury may result.
15. Know your exit routes and familiarize yourself with the JPS Health Network's Disaster and Emergency codes. Exit routes must be posted at the entrances/exits of the jobsite at all times.
16. Know where firefighting equipment and the type of extinguisher to use based on the class of fire present.

P – Pull the pin

A – Aim the extinguisher nozzle at the base of the fire

S – Squeeze the handle

S – Sweep the nozzle from side to side

<i>Type of Fire:</i>	<i>Fuel:</i>
Class A	Wood, Paper, Trash, Cloth, etc.
Class B	Flammable Liquids: Gasoline, Diesel, Oil, Paint, etc.
Class C	Electrical

Class K

Cooking oils and greases such as animal fats and vegetable fats

****Caution: Always check the label before using an extinguisher; using the extinguisher improperly or using the wrong extinguisher could result in severe injury or property damage.**

17. Lift correctly – with legs, not the back. If the load is too heavy, get help.
18. All personnel operating equipment must be licensed and/or certified. Equipment includes, but not limited to, lasers, scissor lifts, boom lifts, forklifts, excavation equipment, and cranes/hoisting equipment.
19. Do not use power tools and similar equipment until you have been properly instructed in the safe work methods.
20. Be sure that all guards for tools and equipment remain in place and operable. Do not remove, displace, damage, or destroy any safety device or safeguard furnished with tools and/or equipment.
21. Do not enter an area which has been barricaded.
22. Never oil, lubricate, or fuel equipment while it is running or in motion.
23. Use the “four and one” rule when using a ladder. One foot out for every four feet of height.
24. Portable ladders in use shall be equipped with safety feet. Step ladders shall not be used as a straight ladder.
25. Use ladders according to related OSHA Standards and Guidelines, general ladder safety, and manufactures instructions.
26. Ladders must extend three feet above landing on roof/parapet for proper use.
27. Defective ladders must be properly tagged and immediately removed from the project site.
28. Keep ladder bases free of debris, hoses, wires, materials, etc.
29. Build scaffolds according to manufacturers’ recommendations and applicable OSHA Safety Standards and Guidelines.
30. Scaffold planks shall be properly lapped, cleated, or otherwise secured to prevent shifting.
31. Use only extension cords with three-prongs (grounded). Use ground fault circuit protectors at all times when using temporary power sources. Check electrical tools, equipment, cords, and associated equipment daily. Connecting multiple extension cords (daisy chaining) is not allowed.
32. Use fall protection procedures and devices that comply with all OSHA Safety Standards and Guidelines with regards to Fall Protection.
33. All elevated work surfaces must have handrail and toe boards, as required. Never throw anything when working from an elevated platform. Someone passing below may be seriously injured.
34. Open fires are PROHIBITED.
35. Know what emergency procedures have been established for your job site. (Location of emergency phone (if provided), first aid kit, stretcher location, fire extinguisher locations, evacuation plan, etc).

5.0 Disaster/Emergency Response

5.1 Contacts

5.1.1 Emergency Response Codes

Ext. 22111 - JPS Direct Line

817-702-1120 – All Others

5.1.2 TCHD Police Emergency

Ext. 21120 – JPS Direct Line

817-702-1120 – For Emergencies **ON** JPS Main Campus

911 – For Emergencies **OFF** JPS Main Campus

5.1.3 TCHD Police Non-Emergency

Ext. 21424 – JPS Direct Line

817-702-1424 – All Others

5.2 Emergency Codes

CODE	EMERGENCY
Black	Tornado
Orange	Hazmat Spill
Amber	Missing Patient/Child
Gray	Severe Weather
Silver	Active Shooter/Hostage
Red	Fire
Blue	Cardiac Arrest
Brown	Bomb Threat
Purple	Facility Lockdown
Pink	Infant Abduction
Yellow	Internal/External disaster

MEDICAL ASSIST – Other medical emergency

ALL CLEAR – Previous code has been cleared

5.3 Fire Response

R – Rescue Patients

A – Activate Fire Alarm

C – Confine the Fire

E – Extinguish/Evacuate

6.0 Contractor Competent Safety Person

The Contractor must designate a competent safety person, as defined by OSHA to implement the safety requirements when working on construction or renovation projects within the JPS Health Network. The responsibilities for this position are as follows:

- Assure a safe workplace and OSHA compliance.
- Develop a site specific safety plan before the work starts.
- Ensure all ICRA/PCRA/ILSM permits are posted outside the entry of the project. If within Behavioral Health unit, the ICRA/PCRA/ILSM will be posted on the inside of the entry to the project.
- Maintain project specific job boards with all permits, notifications, OSHA notifications.
- Maintain an updated database of the SDS at the project site.
- Identify, document, and correct potential job hazards and reportable spills.
- Assuring compliance with JPS Health Network's safety and health standard requirements.
- Making regular safety inspections.
- Establishing safety procedures.
- Assure regular safety training with lead persons on site.
- Training his or her employees on JPS Health Network's Emergency Response Procedures.
- Maintaining safety and training records.

7.0 Personal Protective Equipment (PPE)

All construction personnel must be protected from hazards in the workplace by using appropriate PPE, including but not limited to:

A. Head protection (hard hats) on job sites when there are potentials of falling objects, hair entanglement, burning, or electrical hazards. Hard hats are for protection against impact and penetration of falling objects.

- B. Eye and face protection when there are potentials of hazards from flying objects or particles, chemicals, arcing, glare, or dust.
- C. Protective footwear to protect from falling objects, chemicals, or stepping on sharp objects. Athletic or canvas-type shoes shall not be worn.
- D. Protective gloves or clothing when required to protect against a hazard.
- E. Harnesses and lanyards for fall protection as required in OSHA Construction Safety Standards.
- F. Protection against the effects of noise exposure. Also, take appropriate measures to protect Hospital occupants from noise and vibration pollution.
- G. Respirators in accordance with the applicable OSHA Standard when such equipment is necessary to protect the health of the employee.

The proper selection of PPE will be determined during an initial walkthrough of the jobsite before work starts and documented on the site specific safety plan.

- All Personal Protective Equipment must meet the applicable ANSI specifications.

8.0 Utility Outages and/or Disruptions

Under NO circumstances shall a contractor or subcontractor attempt to shut off, tamper with, modify, or impair any existing utilities to include, but not limited to, the following: medical gases, electrical, water, sanitary sewer, and fire alarm/suppression.

ALL utilities in need of shut off shall be coordinated with the JPS Project Manager through the Facilities Engineering Department.

The contractor is responsible for performing lock out/tag out procedures in accordance with all OSHA Standards and Guidelines.

9.0 Blood Borne Pathogens

Biological hazards or containers storing biohazard items such as needles or sharps must be removed by JPS Health Network personnel only. If the contractors find a biohazard container or biohazard material, they must contact the JPS Project Manager for proper handling.

10.0 Confined Space Entry

In the event that a confined space entry is required, the Contractor must coordinate entry to the confined spaces with the JPS Project Manager. The entry must comply with OSHA Standards and Guidelines regulation confined space entry.

11.0 Asbestos

Contractor must not disturb any asbestos-containing material. If any asbestos-containing material is suspected within the limits of the scope of work to be performed, immediately stop work and contact the JPS Project Manager to evaluate the condition.

12.0 Tobacco/Smoking Policy

JPS Health Network is committed to providing a healthy environment for all occupants. All tobacco use is prohibited at all JPS Health Network facilities, including electronic cigarettes and smokeless tobacco.

13.0 Safety Data Sheet (SDS)

Contractor is responsible for compiling a master file of SDS's of all chemicals and building materials used on JPS Health Network projects. Such file should be submitted as part of the site specific safety plan. Contractor must also have a book containing all SDS's, or a reference page referring to an online database with a list of all hazardous chemicals, at project site and update as necessary.

14.0 Radiation Safety

Some projects require work in an area of JPS Health Network that provides Radiological Services. Common areas in JPS Health Network where internal/external radiation is utilized are as follows: Nuclear Medicine, X-ray, Radiation Therapy, Cath lab, CT scan, Angiography, and Mammography. It can also be found in patient care areas when the portable X-ray machine is used. Radiation procedures using controlled doses of radiation as well are performed in rooms constructed to contain levels of exposure. All work required in these areas shall be coordinated with the JPS Project Manager.

MRI (magnetic resonance imaging) is a way to see inside the human body that does not use radiation. Just because there is no radiation there is still a risk with MRI. MRI uses a very strong magnetic field to produce detailed pictures of the body. This magnetic field increase greatly as you move closer the magnet. These fields extend sphere or circle around the scanner so the dangers are not contained only in the scan rooms. This static magnetic field can pull metallic items at high velocities towards the magnet. Significant injury, even death can occur to individuals in the MRI scanner suite if a ferromagnetic object (items containing iron) or a device with ferromagnetic components is exposed to the magnetic field. The level of danger is denoted by signage. MRI is split into 4 zones:

- Zone 1- no risk, the front entry to the hospital
- Zone II- no risk, where you will be screened to enter MRI
- Zone III- potential risk, you must be screened to enter anywhere with a zone III sign. Even if there is equipment or rooms in this area that you are required to access. You must not tailgate or ask anyone other than an MRI tech to let you in. If you are found in a Zone III area and have not been screened you will be removed from the job.
- Zone IV- high risk, this is the magnet scan room. Must be screened and accompanied by a MRI tech at all times.

If you are found in a Zone III or IV area and have not been screened you will be removed from JPS property.

Apart from the risk of the static magnetic field there is also a risk on the roof from ultra-cold gases. MRI's is cooled by liquid helium kept at roughly -425 degrees Fahrenheit. The release of this ultra-cold gas is called a quench. This can be both planned and spontaneous. During a quench the cryogen gas is released through the quench pipes on the roof. JPS currently has 3 MRI Quench pipes on the roof. If you notice gases being released it is important to evacuate the roof promptly. There is no static field concerns on the roof unless you are cutting into the roof.

15.0 Contractor Badging

All contractor employees are required to have personal company specific photo badges on their person at all times. Once orientation has been completed an annual orientation sticker will be issued from the JPS District Safety Department to be placed on the contractor's badge. Under no circumstances shall a person wear someone else's badge.

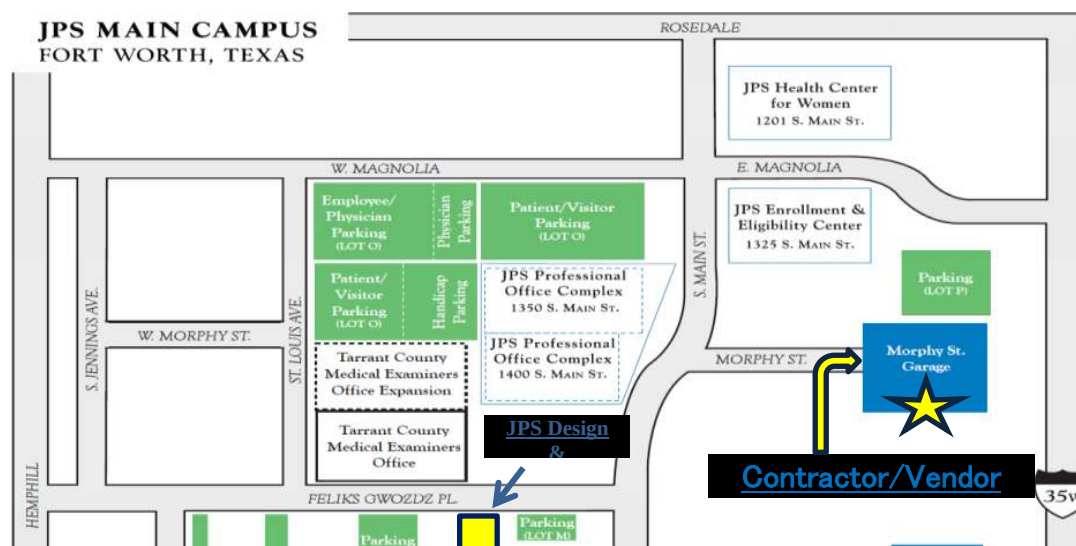
JPS access badges will be issued out to the project superintendent on a project by project basis. The quantity will be based on the scope, size, duration, and location of the project. JPS access badges are \$100.00 a piece if they are lost or broken.

Contracted personnel must provide evidence of all employees being free of active tuberculosis (TB) (e.g. TB skin, blood test or questionnaire) before commencing any work within JPS Health Network stickers.

If any contractor is found not following the rules set in place by JPS, there will be a one strike warning before the contractors sticker will be taken and retraining will need to take place in order to get another sticker. If the contractor still does not follow the safety rules after retraining then they will not be allowed back onto JPS property in the future.

16.0 Parking

All contractor and subcontractor employees must park their vehicles in approved designated areas coordinated with the JPS Project Manager. The Morphy Street Parking Garage (Lot Q) and Lot P (north of Lot Q) provides parking that has been designated for contractors use. Contractors must not block public areas while loading and unloading materials and equipment.



17.0 Job Safety Training

Contractor is responsible for training and documenting his or her employees on:

- All OSHA required training, and
- JPS Health Network Health and Safety information.
- Infection Control Sheets

18.0 Reportable Events

All events such as spills, property damage, and any injuries must be reported to the JPS Construction Safety Officer as soon as they occur and in writing within 24 hours.

19.0 Risk Assessments

19.1 Pre-Construction Risk Assessment (PCRA)

A PCRA must be conducted before any work commences. Contractors working at JPS Health Network must implement all items prescribed within the PCRA, with no exceptions. Please reference **JPS Policy LS-401**.

The Contractor's competent safety person will tour the project site and observe potential safety/health hazards, including the potential hazards of confined spaces and develop a site-specific safety plan for safeguarding the Hospital, which may include the following:

- ✓ Removing the hazard when discovered.
- ✓ Guarding against the hazard as required by the PCRA, ICRA and ILSM.

- ✓ Providing personal protective equipment and enforcing its use.
- ✓ Training workers in safe work practices
- ✓ Coordinating protection of workers through other contractors.

19.2 Interim Life Safety Measures (ILSM)

ILSM's are a series of administrative actions, as outlined by The Joint Commission (TJC) Life Safety Standard, required to be taken, as appropriate to temporarily compensate for hazards caused by construction and renovation activities within the facilities of the JPS Health Network.

ILSM's required are assessed in conjunction with the PCRA, must be implemented at project startup, and continue until the hazard posed by the construction or renovation activity is removed.

Please reference **JPS Policy LS-201**.

In the event that a project is found to be non-compliant with a prescribed measure, the contractor will be immediately notified. The contractor will then have up to 4 hours to bring the non-complying measure into compliance, if deemed hazardous, then the contractor will immediately correct the hazard. Should the contractor fail to bring the non-complying measure into compliance within the required period of time allocated, the JPS Project Manager will bring the measure into compliance at the expense of the contractor.

19.3 Infection Control Risk Assessment (ICRA)

Dust is one of the leading causes of the spread of infectious diseases. The risk for infections could be significantly increased during periods of construction. Therefore, they are assessed and proper measures are taken to reduce/eliminate the potential risks identified. Minor air quality control issues must be resolved within 24 hours, major air quality control issues will be resolved immediately.

Please reference **JPS Procedure IC-137**.

See **Appendix B – Infection Control Key Points** for implementation of ALL construction projects performed within the District.

20.0 Permits

20.1 Infection Control Permit

An Infection Control work permit will be provided for ALL projects deemed to have a potential risk for the spread and communication of infectious diseases.

A copy of the Infection Control Permit must be maintained at the jobsite at all times. A copy of the assessment form is required to be kept with the permit.

DUST CONTAINMENT REQUIREMENTS

HEPA Cart:

- Class II construction or maintenance activities that are small
- Work is done in a hallway, lobby, or area where patients and/or staff are present at any time and work cannot be contained behind a closed door

Soft Containment (FRP):

- Class III construction or maintenance activities that are small and last for multiple shifts or occur within congested environments
- Short-term construction or maintenance activities that are completed within 5 days

Hard Containment:

- Class III and IV construction or maintenance activities in Behavioral Health
- Class III and IV construction or maintenance activities that are large, and/or long-term projects lasting longer than 5 days
- Class IV construction or maintenance activities that require an anteroom
- Work performed is occurring in a high-traffic area or highest risk location

20.2 Hot Work Permit

Contractors must obtain a Hot Work Permit prior to the start of any work which produces a flame, hot spot, or fire related concern. These include, but are not limited to, welding, cutting, grinding, torching, burning, or any other heat or spark producing operations. These permits are only good for the day issued and specifically for the task on the permit, unless otherwise stated. Any change of the task parameters, or outside of the given timeline, a new permit must be issued. These operations must be performed in accordance with OSHA Standards and Guidelines.

All compressed gas cylinders must be transported, handled and stored in accordance with OSHA 29 CFR 1926 Subpart J. Acetylene gas and other flammable gases must be removed, by the contractor, from the hospital at the end of every day before leaving the job site.

A fire extinguisher that has a current inspection must be maintained in the immediate access area of the hot work at all times. A fire extinguisher will be checked out at the time of permit application.

- Person requesting a Hot Work Permit will be required to complete a pre-inspection of the worksite before the permit is issued. The inspection will be documented on the pre-inspection form.
- A fire watch is required during all hot work and minimum 30 minutes after the work has completed. It will be documented on the fire watch form.
- Once the fire watch has ended the permit and fire watch form will be returned to the JPS District Safety office.
- Permits must be pulled and returned daily.

District Safety will be issuing permits from 7am – 5pm Monday - Friday. There will be a box located outside the office for completed forms to be placed in after hours.

For permits needed after hours and on weekends, the on-call Safety Representative will be notified.

20.3 Above Ceiling Work Permit

20.3.1 General Information

The intent of JPS Health Network's Above Ceiling Work Permit Program is to help ensure that openings and/or opportunities in fire/smoke barriers are noted, sealed, and inspected, to prevent the spread of fire/smoke, in accordance with NFPA Life Safety Code, 101 requirements.

Please reference **JPS Policy LS-301**.

Permit applications may be obtained from the Plant Operations Office, between 7:30am and 5:00pm, Monday – Friday. The approved permit must be in the possession of the person performing the work at all times while the work is underway.

20.3.2 Permit Instructions.

1. The above ceiling work permit must be secured prior to beginning any work (no exceptions).
2. The permit may be secured from the office of Facility Engineering, Main Campus, 1500 S. Main Street, Ft. Worth, TX 76104: Phone 817-702-1371.
3. The permittee will provide a copy of the floor plan(s) and the ICRA for the area where the work will take place.
4. The path that the job follows is to be indicated on this plan. This floor plan will be used for the permit approval and final inspection at work completion.
5. All permitted penetrations must be resealed using an appropriate, pre-approved smoke/fire stopping system/materials prior to final inspection/approval. All penetration and attachments must be made in accordance with NFPA, The Joint Commission (TJC), and the Underwriters Laboratory (UL). Only the STI fire/smoke stop system is acceptable.
6. All Junction Boxes (J-boxes) and other electrical devices used above ceiling must be properly installed, supported, labeled and sealed.
7. The exact locations of all penetrations must be identified, inspected, and approved after completing of work.
8. Above ceiling permits must be closed prior to submitting for final payment.

20.4 Red Tag Permit

The contractor must obtain a Red Tag Permit from the JPS Life Safety Systems Coordinator 24 hours prior to impairing any fire protection system within the JPS Health Network. This permit

is applicable, but not limited to, fire sprinklers, pumps, and CO₂ systems. Whenever any fire alarm system is taken out of service for more than 4 hours, or any fire sprinkler system is taken out of service for more than 10 hours, the contractor must provide dedicated fire watch(s) in the affected area.

20.5 Energized Electrical Work Permit

20.5.1 General Information

The intent of JPS Health Network's Energized Electrical Work Permit Program is to help ensure that only when necessary the electrical system is worked on live, and in the case that it does have to be it ensures that everyone involved is fully aware and in compliance with NFPA 70E.

Permit applications may be obtained from the Design & Construction Office, between 7:30am and 4:30pm, Monday – Friday. The approved permit must be in the possession of the person performing the work at all times while the work is underway.

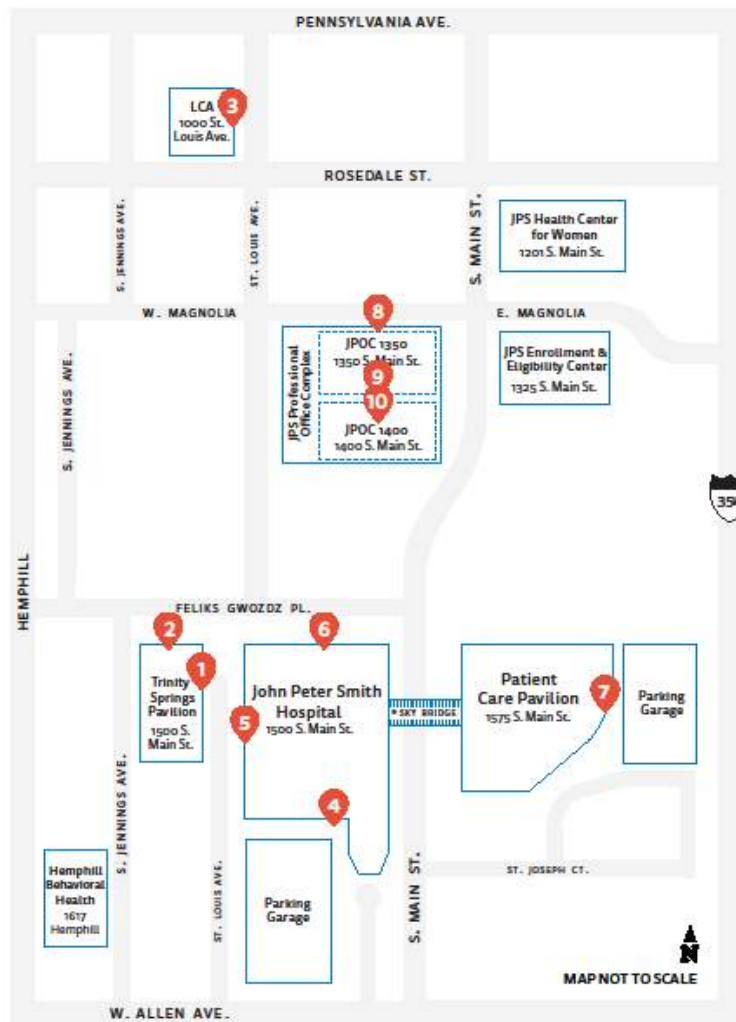
21.0 Construction Activities during COVID-19 Pandemic

21.1 General Information

- All contractors and subcontractors are asked to stay home if they are exhibiting any signs of sickness.
- While on any JPS property, all workers are required to wear masks over their nose and mouth to prevent them from spreading the virus.
- Ensure that extra COVID-19 specific PPE is kept within easy access of workers in case of PPE damage.
- Contractors will need to undergo the JPS screening process at one of the approved entry points on a daily basis before any work activities begin. **Please refer to attached map for Main Campus and surrounding areas**
- Continue to use other normal control measures, including personal protective equipment (PPE), necessary to protect workers from other job hazards associated with construction activities.
- Advise workers to avoid physical contact with others and direct employees/contractors/visitors to increase personal space to at least six feet.

- Encourage respiratory etiquette, including covering coughs and sneezes.
- Promote personal hygiene. Wash hands with soap for at least 20 seconds or use an alcohol-based hand sanitizer. Key times for contractors to clean their hands include:
 - Before and after work shifts
 - Before and after work breaks
 - After blowing their nose, coughing, or sneezing
 - After using the restroom
 - Before eating or preparing food
 - After putting on, touching, or removing cloth face coverings
- When tools or equipment must be shared, contractors shall use alcohol based wipes to clean tools before and after use. **When cleaning tools and equipment, workers should consult manufacturer recommendations for proper cleaning techniques and restrictions.**
- Keep in-person meetings (including toolbox talks and safety meetings) as short as possible, limit the number of workers in attendance, and use social distancing practices.
- Frequently-touched items (i.e., door pulls, punch locks, etc.) should be disinfected on a regular basis. The frequency will be based on Pre-Construction and Infection Control Risk Assessments.
- Encourage workers to report any safety and health concerns. Contractors can refuse to work if they feel it is unsafe for them due to COVID-19 related issues.
- Minimize the number of workers present at worksites to only allow essential contractors.

21.2 Screening Entrances



Team Member Screening Entrances

Behavioral Health

1. Trinity Springs Pavilion, front entrance
2. Trinity Springs Pavilion, back entrance
3. Local Commitment Alternative (LCA)

Main Hospital Building

4. Southside of the building (facing the parking garage)
5. West entrance (by flagpoles)
6. Warrant Entry to basement (lower level)

Patient Care Pavilion

7. Garage entrance (first floor)

JPOC 1350

8. North entrance (first floor)
9. South entrance (first floor)

JPOC 1400

10. Main entrance on (first floor)



Jobsite Required Postings: PCRA, ICRA, ILSM, EVAC, HOT WORK, ABOVE CEILING, SAFETY PLAN, CONTRACTOR ORIENTATION PACKET, EMERGENCY CONTACT LIST

APPENDIX A

JPS Emergency Contact List



Emergency Contact List

Contact Title	Contact Name	Office Number	Alt. Number
Director, Design & Construction	Lou Mattingly	817-702-4941	817-903-4782
Construction Operations Manager	Zach Miller	817-702-4935	817-657-7494
Construction Project Manager	Susan O'Donnell	817-702-4942	817-915-7469
Construction Project Manager	Jorge Escatel	817-702-4944	817-578-5584
Construction Safety Officer	Neil Wright	817-702-4943	817-565-7763
Facilities Engineering Senior Manager	Omar Rodriguez	817-702-1252	
Facilities Engineering Senior Manager	Kris Rizzo	817-702-1415	
Information Technology Representative	Jamie Whitener	817-702-1233	
Infection Control Representative	Chrystia Johnson	817-702-5617	
District Safety	Micheal Miller	817-702-1570	
Fire Safety Supervisor	Eric Wagner	817-702-6968	

Emergency Response Codes

Ext. 22111 - JPS Direct Line
817-702-1120 – All Others

TCHD Police Emergency

Ext. 21120 – JPS Direct Line
817-702-1120 – For Emergencies **ON** JPS Main Campus
911 – For Emergencies **OFF** JPS Main Campus

TCHD Police Non-Emergency

Ext. 21424 – JPS Direct Line
817-702-1424 – All Others

APPENDIX B

Infection Control

Key Points

Contractor Infection Control Training Key Points



- IRCA book information posted out front of project.
- Construction areas must be isolated from occupied areas using appropriate containment barriers.
- Only authorized persons are allowed to enter the construction area.
- Signs must be posted to keep pedestrian traffic away from the construction area.
- Appropriate personal protective equipment must be worn in construction site, as prescribed by the Infection Control Permit and the Site Specific Safety Plan.
- Clothing, tools, and equipment must be free of loose soil and debris before they leave the construction area.
- Worksite must be swept or vacuumed with a HEPA-filtered vacuum multiple times daily to remove dust and debris if IRCA required.
- Areas adjacent to the construction area must be damp mopped one or more times per day if IRCA required
- Walk-off mats must be placed and maintained at worksite entrances to minimize dust by construction workers.
- Transport of construction materials, tools, equipment in and out of project site must be covered, and minimized until project completion.



PLACE HOLDER FOR JPS FORMS (INSERT)

ILSM POLICY (FORMS)

SAFETY PROGRAM

METHOD OF PROCEDURE (MOP) FORM

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Specifications format and conventions, abbreviations, acronyms and definitions used throughout the Contract Documents, and requirements pertaining to reference standards listed in the Project Manual, indicated on the Drawings, or otherwise applicable to the Project.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": The term "approved," when used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract, without any implied meaning extending the Architect's responsibility into the Contractor's area of Contractor coordination, supervision, or means and methods of construction as outlined in the Conditions of the Contract.
 - 1. In no situation will an approval by Architect release Contractor from responsibility to fulfill requirements of the Contract Documents.
- C. "As Indicated": Means indicated in the Contract Documents. Other terms, including "shown", "noted", "scheduled", and similar terms have the same meaning as "indicated".
- D. "Authorities Having Jurisdiction" (AHJ): Means the agencies, either individually or collectively, charged by statute with administration and enforcement of the requirements of building codes and other regulations at the Project location.
- E. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.
- F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
- H. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- I. "Installer": Means the Contractor or other entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor to perform a particular construction operation at the Project site, including preparation, erection, installation, application, construction, re-installation, and similar operations required for execution of the Work.
- J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

- K. "Project Manual": A volume or volumes assembled for the Work which may include the procurement requirements, contracting requirements, and Specifications.
- L. "Project Site": Space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. 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.
- M. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- N. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: Where 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 uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. 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.
 - 2. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on Project must 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 the publication source and make them available on request.
 - 2. Referenced standards may be obtained through appropriate web sites:
 - a. ASTM: www.astm.org
 - b. ANSI: www.ansi.org/catalog/search.html
 - c. NFPA: www.nfpa.org/products/listing.html
- E. Abbreviations and Acronyms for Standards and Regulations: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication.
- F. Industry Organizations: Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 42 16

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DEFINITIONS:

- A. General Explanation: A substantial amount of specification language defines terms found in other Contract Documents, including drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the work to extent not stated more explicitly in another provision of Contract Documents.
- B. General Requirements: The provisions or requirements of Division 0 and Division 1 sections. General Requirements apply to entire work of Contract and, where indicated, to other elements which are included in project.
- C. Indicated: The term "Indicated" is a cross reference to details, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
- D. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by Architect", request by "Architect", etc. However, no such implied meaning will be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.
- E. Approved: Where used in conjunction with Architects response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Architects responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents.
- F. Project Site: The space available to Contractor for performance of the work, either exclusively or in conjunction with others performing other work as part of the project. The extent of project site is shown on drawings and may or may not be identical with description of land upon which project is to be built.
- G. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

- H. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unloading, storage, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
- I. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
- J. Installer: The entity (person or firm) engaged by Contractor or its subcontractor or sub-subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.
- K. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the work, either at project site or elsewhere; or to report and (if required) interpret results of those inspections or tests.
- L. Owner Furnished Equipment (OFE): OFE refers to the Owner's equipment purchased for the project by the owner regardless of installation.
- M. Owner Furnished - Contractor Installed (OFCI): Equipment or components of a system that are purchased by the Owner and furnished to the Contractor for installation in the project. The Contractor shall receive, store, protect, install, connect and test each item unless otherwise indicated.
- N. Contractor Furnished - Contractor Installed (CFCI): Equipment or components of a system that are purchased, furnished and installed by the Contractor.
- O. Owner Furnished - Owner Installed (OFOI): Equipment or components of a system that are purchased, furnished and installed by the Owner or his vendors.

1.3 FORMAT AND SPECIFICATION EXPLANATIONS:

- A. Specification Production: None of these explanations will be interpreted to modify substance of requirements. Portions of these specifications have been produced by Architect's standard methods of editing master specifications, and may contain minor deviations from traditional writing formats. Such deviations are a normal result of this production technique, and no other meaning will be implied or permitted.
- B. Format Explanation: The format of principal portions of these specifications can be described as follows; although other portions may not fully comply and no particular significance will be attached to such compliance or noncompliance.
 - 1. Sections and Divisions: For convenience, basic unit of specification text is a "section", each unit of which is named and numbered. These are organized into related families of sections, and various families of sections are organized into "divisions", which are recognized as the present industry consensus on uniform organization and sequencing of specifications. The section title is not intended to limit meaning or content of section, or to be fully descriptive of requirements specified therein, or to be an integral part of text.
 - 2. Imperative Language: Used generally in specifications. Except as otherwise indicated,

requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by Contractor, or when so noted, by others.

3. Section Numbering: Used to facilitate cross references in Contract Documents. Sections are placed in Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and names of specification section in Contract Documents.
- C. Specification Content: Because of methods by which this project specification has been produced, certain general characteristics of content and conventions in use of language are explained as follows:
1. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive", "open generic descriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.
 2. Overlapping and Conflicting Requirements: Where compliance with two (2) or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, most stringent requirement (which is generally recognized to be also most costly) is intended and will be enforced, unless specifically detailed language written into contract documents (not by way of reference to an industry standard) clearly indicates that a less stringent requirement is to be fulfilled. Refer apparently-equal-but-different requirements, and uncertainties as to which level of quality is more stringent, to Architect/Engineer for a decision before proceeding.
 3. Contractor's Options: Except for overlapping or conflicting requirements, where more than one set of requirements are specified for a particular unit of work, option is intended to be Contractor's regardless of whether specifically indicated as such.
 4. Minimum Quality/Quantity: In every instance, quality level or quantity shown or specified is intended as minimum for the work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect/Engineer for decision before proceeding.
 5. Specialists; Assignments: In certain instances, specification text requires (or at least implies) that specific work be assigned to specialists or expert entities, who must be engaged for performance of those units of work. These must be recognized as special requirements over which Contractor has no choice or option. These assignments must not be confused with (and are not intended to interfere with) normal application of regulations, union jurisdictions and similar conventions. One purpose of such assignments is to establish which party or entity involved in a specific unit of work is recognized as "expert" for indicated construction processes or operations. Nevertheless, final responsibility for fulfillment of entire set of requirements remains with Contractor.
 6. Trades: Except as otherwise indicated, the use of titles such as "carpentry" in specification text, implies neither that the work must be performed by an accredited or unionized tradesperson of

corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradespersons of that corresponding generic name.

7. Abbreviations: The language of specifications and other contract documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordinating specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated.

a. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the contract documents so indicates.

1.4 DRAWING SYMBOLS:

- A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated.
- B. M/E Drawings: Graphic symbols used on mechanical/electrical drawings are generally aligned with symbols recommended by ASHRAE, supplemented by more specific symbols where appropriate as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to Architect/Engineer for clarification before proceeding.

1.5 INDUSTRY STANDARDS:

- A. General Applicability of Standards: Applicable standards of construction industry have same force and effect (and are made a part of Contract Documents by reference) as if copied directly into Contract Documents, or as if published copies were bound herewith.
- B. Referenced Standards: (referenced directly in contract documents or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.
- C. Non-referenced standards are hereby defined to have no particular applicability to the work, except as a general measurement of whether work complies with standards recognized in construction industry.
- D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of Contract Documents.
- E. Copies of Standards: Provide where needed for proper performance of the work; obtain directly from publication sources.
- F. Abbreviations and Names: The acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. It is incumbent upon the Contractor to reference the proper trade group or association as necessary to follow current requirements.

1.6 GOVERNING REGULATIONS/AUTHORITIES:

- A. General: The procedure followed by Architect has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing Contract Documents; recognizing that such information may or may not be of significance in relation to Contractor's responsibilities for performing the work. The Contractor shall also contact governing authorities directly for necessary information and decisions having a bearing on performance of the work.

1.7 SUBMITTALS:

- A. Permits, Licenses and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 42 16

SECTION 01 45 00

QUALITY PROCEDURES AND CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Contractor shall comply with the following requirements:

1.2 RELATED DOCUMENTS

- B. Drawings and general provisions of Contract, including General Conditions and other Specification sections (including Verification and Commissioning Requirements), apply to work of this section.

1.3 DESCRIPTION OF WORK

- A. The minimum requirements for procedures and performance of general control work include but are not limited to the following categories and Specifications Sections or Contractual Requirements:

1. Coordination and meetings.
2. Surveys and records or reports.
3. Limitations for use of site.
4. Tradesmen and workmanship standards.
5. Inspections, tests and reports.
6. General installation provisions.
7. Cutting and patching.
8. Cleaning and protection.
9. Conservation and salvage.

1.4 COORDINATION AND MEETINGS

- A. General: Prepare and distribute to each entity performing work at project site, a written memorandum of instructions on required coordination activities, including required notices, reports and attendance at meetings. Prepare similar memorandum for separate contractors where interfacing of work is required.
- B. Conduct meetings as in Section 01 31 19.

1.5 SURVEYS AND RECORDS/REPORTS

- A. General: Working from lines and levels established by property survey, and as shown in relation to the work, establish and maintain bench marks and other dependable markers to set lines and levels for the work at each story of construction and elsewhere on site as needed to properly locate each element of entire project. Calculate and measure required dimensions as shown (within recognized tolerances if not otherwise indicated); do not scale drawings to determine dimensions. Advise tradesmen performing the work, of marked lines and levels provided for their use in layout of work.
- B. Surveyor: Engage a Land Surveyor or a Professional Engineer experienced and specializing in land

survey work, which is registered in State where project is located, to perform services specified in this article.

- C. Survey Procedures: Verify layout information shown on drawings, in relation to property survey and existing bench mark, before proceeding with layout of actual work. As work proceeds, check every major element for line, level and plumb (where applicable), and maintain as accurate surveyor's log or record book of such checks, available for Architect's reference at reasonable times. Record deviations from required lines and levels, and advise Architect promptly upon detection of deviations exceeding indicated or recognized tolerances.
- D. Final Property Survey: Immediately before the time of final completion, prepare a final property survey showing significant features (real property) resulting from construction of project including drives, parking lots, buildings, and property lines. Include on survey signed certification by surveyor that principal lines and levels of project are accurately positioned as shown on survey.
 - 1. Submit copies as requested by the Architect and Program Manager.
 - 2. Provide Reports as in Section 01 32 26.

1.6 LIMITATIONS FOR USE OF SITE

- A. General: In addition to site utilization limitations and requirements shown on drawings, and indicated by other Specifications or Contract Documents, administer allocation of available space equitably among entities needing access and space, so as to produce best overall efficiency in performance of total work of project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.
- B. Burial of Waste Materials: Do not dispose of any materials on the site, either by burial or burning.
- C. Staging, Lay down areas, parking, and site circulations are to be described as follows: Provide a site plan for identifying material staging and lay down areas, office trailers, parking or facilities for workers. If all work is internal to the hospital, provide a description of the parking, office space and material staging areas.

1.7 TRADESPERSONS AND WORKMANSHIP STANDARDS

- A. General: Ensure persons performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required workmanship quality levels in completed work. Ensure that workers have proper healthcare construction knowledge as required in the contract documents.
- B. WHEN A WORKER OR SUB-CONTRACTOR IS IDENTIFIED TO BE INSUFFICIENT IN KNOWLEDGE AND QUALITY OF WORK, THE CONTRACTOR SHALL REPLACE IMMEDIATELY AND WITHOUT REGARD TO OTHER TERMS AND CONDITIONS BETWEEN CONTRACTOR AND SUBCONTRACTOR.
- C. Availability of Tradespersons: At each progress or coordination meeting, review availability of tradespersons and projected needs to accomplish work as scheduled. Require each prime entity employing personnel to report on current and pending trade union actions and jurisdictional matters which might affect progress of work. Where possible, consider alternatives and take actions to avoid disputes and delays.

1.8 INSPECTIONS, TESTS AND REPORTS

- A. General: Required inspection and testing services are intended to assist in determining probable compliances of work with requirements, but do not relieve Contractor of responsibility for those compliances, or for general fulfillment of requirements of Contract Documents. Specified inspections and tests are not intended to limit Contractor's quality control program. Allow reasonable access to agencies performing tests and inspections.
- B. Owner's Tests: Where on-site tests or inspections are indicated to be the responsibility of the Owner, the Program Manager will engage independent testing agency on behalf of the Owner to perform required services. Where the Owner is responsible for hiring the testing agent but the contractor is required to coordinate their activities while on site or coordinating testing times, the Contractor will provide written notification to the Owner and testing agent for times and testing availability. When required inspections are being coordinated by the Contractor, the Contractor will ensure timely inspections for the maintenance of the Contractors schedule. The Owner will provide for distribution of testing results to the Architect, Engineer and Contractor.
- C. Contractors Tests: Tests and Inspections not assigned to the Owner are the Contractors responsibility. When the Test or Inspection is required by the Contractor the Contractor will coordinate the activities as in article B. above for timely execution and reporting. The Contractor will engage professionals for testing who meet or exceed the stated inspector qualifications in the Contract Documents.
- D. Reports: The Owner's agency will submit test/inspection reports, including agency's analysis of results and recommendations where applicable, to the Owner, Contractor and Architect except as otherwise indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- A. Unless otherwise indicated the Contractor will provide quality control services required of the Contractor by the Owner, the Architect or the Authority having jurisdiction (AHJ) as stated in the Contract Documents or by the manufacturer, the AHJ or other parties weather specified or not in order to provide the highest quality installation and process possible.
- B. Pre-Installation Conferences: See also Section 01 31 19. Set meeting w/Architect, Owner, Program Manager, Installers and Manufacturers Representatives before installation of major units of work including at a minimum Earthwork; Site Utilities; Foundation; Framing; Exterior Systems; Roofing; Interior Finishes; Mechanical, Electrical, and Plumbing Systems. Refer to Specification Sections for additional Pre-Installation Conferences required. Advise Architect and Program Manager of scheduled meeting dates. At each meeting, review progress of other work and preparations for particular work under consideration, record minutes of each conference and distribute record of meeting within three (3) days to everyone concerned, including Architect and Owner.
 - 1. Do not proceed with the work if associated pre-installation conference cannot be concluded successfully. Instigate actions to resolve impediments to performance of the work, and

reconvene conference at earliest date feasible.

- C. Installer's Inspection of Conditions: Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.
- D. Manufacturer's Instructions: Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation, to extent these are more explicit or more stringent than requirements indicated in Contract Documents.
- E. Inspect each item of materials or equipment immediately prior to installation, and reject damaged and defective items.
- F. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerances if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.
- G. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
- H. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work, in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.
- I. Coordinate enclosure (closing-in) on work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.
- J. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry-recognized standard mounting heights for applications indicated. Refer questionable mounting height choices to Architect/Engineer for final decision.

3.2 CUTTING AND PATCHING

- A. General: Do not cut-and-patch structural work in a manner resulting in reduction of load-carrying capacity or load/deflection ratio; submit proposed cutting and patching to Architect/Engineer for structural approval before proceeding. Do not cut-and-patch operational elements and safety-related components in a manner resulting in reduction of capacities to perform in manner intended or resulting in decreased operational life, increased maintenance, or decreased safety. Do not cut-and-patch work which is exposed on exterior or in occupied spaces of building, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory or otherwise objectionable manner.
- B. Materials: Except as otherwise indicated or approved by Architect, provide materials for cutting-and-patching which will result in equal-or-better performance and appearance (where applicable) than work being cut-and-patched; Use materials identical with original materials where feasible and where recognized that satisfactory results can be produced thereby.
- C. Temporary Support and Protection: Provide adequate temporary support for work to be cut, to

prevent failure. Do not endanger other work. Provide adequate protection of other work during cutting-and-patching; to prevent damage; and provide protection of the work from adverse weather exposure.

D. Cut work by methods least likely to damage retained and adjoining work.

1. Where physical cutting action is required, cut work with sawing and grinding tools, not with hammering and chopping tools.
2. Comply with the requirements of applicable sections of Division 2 where cutting-and-patching requires excavating and backfilling.

E. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.

1. Where feasible, inspect and test patched areas to demonstrate integrity of work.

F. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.

1. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coats.

3.3 CLEANING AND PROTECTION

- A. General: See also Section 01 50 00. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- B. Limiting Exposures of Work: To extent possible through reasonable control and protection methods, supervise performance of work to ensure that none of the work (whether completed or in progress), will be subjected to dangerous, damaging, to otherwise harmful exposures during construction period. Such exposures include but are not limited to static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

3.4 CONSERVATION AND SALVAGE

- A. See also Sections 01 35 19 and 01 74 19. Carry out construction operations with maximum practical consideration for conservation of energy, water and materials; and with maximum practical consideration for salvaging materials and equipment involved in performance of the work but not incorporated therein.

END OF SECTION 01 45 00

**SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Specifications section 01 11 00, Drawings and general provisions of the Contract, including General Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section shall not limit the types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Owner, Program Manager or Architect that such temporary activity is not required for successful completion of the work and compliance with requirements of Contract Documents. Provisions of this section include but are not limited to utility services, construction facilities, security/protection provisions, and support facilities.

1.3 QUALITY ASSURANCE

- A. General: In addition to compliance with governing regulations and rules/recommendations of franchised utility companies, comply with specific requirements indicated and with applicable local industry standards for construction work (published recommendations by local consensus "building councils").
- B. The Contractor shall comply with all related local, state and federal codes and ordinances regarding the temporary measures for the project. It shall be the responsibility of the Contractor to know, understand and follow the applicable codes and ordinances.
- C. The Owner is required to provide an Environmental Impact Statement (EIS) when requested by the Contractor. The Contractor shall comply with provisions of Owner's committed EIS, for development and operation of temporary facilities and construction activities.
- D. Conservation: In compliance with Owner's policy on sustainability and waste management (see also Sections 013519 and 017419), install and operate temporary facilities and perform construction activities in manner which reasonably will be conservative and avoid waste of energy and materials including water. The Owner follows the provisions of the Green Globes Initiative. For additional information the Contractor shall consult with the Program Manager and the facility for specific requirements.

1.4 JOB CONDITIONS

- A. General: Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced the need.
- B. Conditions of Use: Install, operate, maintain and protect temporary facilities in a manner and at locations which will be safe, non-hazardous, sanitary and protective of persons and property, and free of harmful effects.

- C. Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities. See also the terms and conditions for warranty and maintenance in the A201 General Conditions of the Contract.

1.5 NO SMOKING OR TOBACCO POLICY

- A. Do not expose building occupants and systems to Environmental Tobacco Smoke (ETS) or other forms of tobacco use.
- B. Do not smoke anywhere on campus. Consult with the facility representative for campus boundaries.

PART 2 - PRODUCTS AND EXECUTION

2.1 TEMPORARY UTILITY SERVICES

- A. The types of services required include, but are not limited to, water, sewerage, surface drainage, electrical power and telephones. Where possible and reasonable, connect to existing franchised utilities for required services; and comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
 - 1. Potable Water: Water connection (without charge) to Owner's existing potable water system is limited to one, 3/4" pipe-size connection, and a minimum flow of 10 gpm.
 - 2. Temporary Power Service: Provide service with ground-fault circuit interrupter features, activated from each circuit of 20-amp or less rating.
 - 3. Metering: At Program Manager's discretion and where connected to Owner's existing service, provide meters for water and electrical power services. Read meters and record readings weekly, and include in progress report to Architect/Engineer and Owner at monthly intervals.

2.2 TEMPORARY CONSTRUCTION FACILITIES

- A. The types of temporary construction facilities required, include, but are not limited to, water distribution, drainage, erosion control, dewatering equipment, enclosure of work, heat, ventilation, electrical power distribution, lighting, hoisting facilities, dust or noise partition, stairs, ladders, seeding and roads. Provide facilities reasonably required to perform construction operations properly and adequately.
 - 1. Water Distribution: Pipe to each floor level and provide hose lengths sufficient to reach entire area of construction work, not less than 3/4" hose size. Prevent freezing of water distribution by either prompt drainage after each use, or by suitable protection.
 - 2. Enclosure: Provide temporary enclosure where indicated and where reasonably required to ensure adequate workmanship and protection from weather and unsatisfactory ambient conditions for the work, including enclosure where temporary heat is used. Provide tarps with UL label and flame spread of fifteen (15) or less; provide translucent type (nylon reinforced polyethylene) where day lighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting. The use of tarps or plastic may only be used where the ICRA plans allow and when not in violation of any local, state or federal code.

3. Heating: Use steam or hot water when possible and where available and, where not available, use gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable. The use of any heater within the facility must be approved by the Owner and not put the facility at risk with regard to flame local, state or federal codes. Use of gasoline- or kerosene-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited
4. Electrical Power: Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, lighting, and start-up testing of permanent electrical-powered equipment prior to its permanent connection to electrical system. Provide overload protection and adequate feeder and branch sizes to prevent excessive voltage drop. Locate multiple outlets (not less than 4-gang) at each story of construction.
 - a. Supply power for electrical welding, if any, from either temporary power distribution system or by engine-driven power generator sets, at Contractor's option.
5. Lighting: Provide temporary lighting of fifty (50) foot candles or more to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug-in task lighting. Provide general lighting with local switching which will enable energy conservation during periods of varying activity (work-in-progress, traffic only, security check, lock-up, etc.) Except for lighting that fulfills security and protection requirements, lighting is meant for working hours only. If off working hours lighting is required for any reason, the Program Manager, and Owner must approve in writing in advance.
6. Temporary Dust Partitions: See also sections 01 35 23 and 01 70 10. Provide temporary dust partitions to isolate noise, dust and debris of construction from areas remaining in operation. Construct partitions conforming to the latest Infection Control Risk Assessments (ICRA) standards as determined in the Owner's Infection Control Risk Assessment, the Architects temporary partitions drawing (if applicable) Partitions are to be constructed at a level commensurate with the required fire rating for the building and location. Use gypsum board finished with one tape joint layer, insulation, sealed dust tight, and shall run from floor to underside of deck or slab above with joints taped. Paint partitions in a manner acceptable to the Owner. The use of plastics is strictly limited to allowable type and thickness as approved by the facility Risk Manager/Infection Control/Plant Operations Director/Program Manager. The Contractor will provide at doors into and out of the partition a walk off sticky mat and carpet around it taped to the floor below and will maintain a written log posted at the location of doors into or out of the dust area to document the time and frequency of the replacement of the walk off mats, vacuuming of the carpet and cleaning of the flooring in and around the areas of the door.
7. Access Provisions: Provide ramps, stairs, ladders and similar temporary access elements as reasonably required to perform the work and facilitate its inspection during installation. Comply with all requests of governing authorities performing inspections. When permanent stairs are available for access during construction, cover finished surfaces with sufficient protection to ensure freedom from damage and deterioration at time of substantial completion. Use of Owner's existing stairs will be permitted first where noted in the infection control plan, and with

the written approval of the Risk Manager/Infection Control/Plant Operations Director/Program Manager, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

8. Existing Elevator Use: Use of Owner's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - a. Do not load elevators beyond their rated weight capacity.
 - b. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
9. Roads: Except as otherwise indicated, develop sub grade and sub base of permanent roadways at earliest possible date, and provide temporary surfacing to serve as temporary roads during construction. Surface sufficiently to provide all-weather, uninterrupted access to construction area, for every form of transportation which can be expected. Maintain temporary roads during construction. Extend temporary roadway development and surfacing in and around construction site as required to accommodate construction activities. When no longer needed as temporary roadway, remove temporary surfacing and restore sub base to conditions required by Contract Documents for permanent development.
10. Parking: Provide temporary or Use designated areas of Owner's existing parking areas for construction personnel at the direction of the Program Manager and the facility representative.

2.3 TEMPORARY VENTILATION

- A. Also see section 01 35 23, Ventilate enclosed areas to assist cure of materials, to dissipate humidity and to prevent accumulation of dust, fumes, vapors, or gases. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.
- B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as needed to maintain clean air for construction operations.
- C. Maintain exhaust airflow as required to maintain negative air pressure in construction zone.
 1. Using existing and or temporary exhaust fans (negative air machines) establish a containment zone under negative pressure (e.g., 5 to 10 Pa. or 0.02 to 0.04 w.g.).
 2. Ensure that exhausted contaminants do not re-enter building through open windows or air intake of the HVAC system.
- D. Construction Indoor Air Quality (IAQ): Conform to the following:
 1. During construction meet or exceed minimum requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995.
 2. Protect stored on-site or installed absorptive materials from moisture damage.
- E. Conform to the following:
 1. Protect ducts from construction dust and debris by covering with tape, plastic, sheet metal, or other approved method. Keep ducts clean from time of rough-in until start-up of heating and

- cooling equipment. FAILURE TO DO SO WILL RESULT IN REPLACEMENT OR ON SITE CLEANING OF THE UNPROTECTED DUCTWORK WITH APPROVAL OF SAME BY THE DESIGN TEAM AND ALL COST S ASSOCIATED TAKEN FROM SOURCES OTHER THAN CONTRACTOR CONTINGENCY OR ALLOWANCES, OR THE OWNER'S FUNDS.
2. Delay installation of absorbent materials such as carpet, furniture, or ceiling tiles until emissions from other construction contaminants (e.g. wet product emissions) have dissipated.
 3. In remodeling areas, seal all return ducts to ensure that contaminants do not enter the HVAC system of occupied areas of building. FAILURE TO DO SO WILL RESULT IN REPLACEMENT OR ON SITE CLEANING OF THE UNPROTECTED DUCTWORK WITH APPROVAL OF SAME BY THE DESIGN TEAM AND ALL COST S ASSOCIATED TAKEN FROM SOURCES OTHER THAN CONTRACTOR CONTINGENCY OR ALLOWANCES, OR THE OWNER'S FUNDS.
 4. During dust producing activities (e.g. drywall installation and finishing) turn ventilation system off, and openings in supply and return HVAC system shall be protected from dust infiltration. Provide temporary ventilation as required to maintain .01 w.c. negative air flow during most of the duration of the daily activities allowing for only temporary reduction as needed for regular access or egress.
- F. Preconditioning: Prior to installation, allow products which have odors and significant VOC emissions to off-gas in dry, well-ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions prior to delivery to Project site.
1. Condition products without containers and packaging to maximize off-gassing of VOCs.
 2. Condition products in ventilated warehouse or other building. Comply with substitution requirements for consideration of other locations.
- G. Post signs informing subcontractors, suppliers, and other persons on site about goals of indoor air quality program.
- H. Replace all filtration media immediately prior to flush out and occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2-1999.
- I. Flush Out: Run HVAC system at highest possible outdoor air setting continuously for 7 days immediately prior to Substantial Completion and through to final completion while maintaining an interior relative humidity of 60% maximum. If occupants are present, provide maximum percent outdoor air consistent with achieving thermal comfort and humidity control. At final completion replace filtration media and reset outdoor air settings to normal operating conditions.

2.4 EROSION CONTROL

- A. Erosion Control: Prior to the disturbance of earthwork the Contractor shall:
1. Identify the required erosion control measures specified by the construction documents.
 2. Know, understand and follow the requirements of the local authority having jurisdiction.
 3. Know, understand and follow the requirements for air quality of the hospital with regard to disturbed earthwork and hospital ventilation.
 4. Perform a pre- construction meeting with the sub-contractors, Civil Engineer and hospital representative to review the requirements.
 5. Provide and install prior to construction, the stated measures to prevent soil erosion, discharge of soil-bearing water runoff and airborne dust entering the hospital.
 6. During construction, the Contractor shall review with the civil engineer, Program Manager and facility representative the maintenance of the barriers for continued compliance.

2.5 SECURITY/PROTECTION PROVISIONS:

- A. Temporary security and protection provisions required include, but are not limited to, fire protection, barricades, warning signs/lights, site enclosure fence, sidewalk bridges, building enclosure/lockup, watchman service, personnel security program (theft prevention), environmental protection, and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site.
- B. Provide security/protection services and systems in coordination with activities and in a manner to achieve 24-hour, 7 day per week effectiveness after the building is closed in.
- C. Fire Extinguishers: Provide types, sizes, numbers and locations as would be reasonably effective in extinguishing fires during early stages, by personnel at project site. Provide Type A extinguishers at locations of low-potential for either electrical or grease-oil-flammable liquids fires; provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10. Post warning and quick-instructions at each extinguisher location, and instruct personnel at project site, at time of their first arrival, on proper use of extinguishers and other available facilities at project site. Post local fire department call number on each telephone instrument at project site.
- D. Permanent Fire Protection: Complete each fire protection element at earliest reasonable date, and make ready for emergency use, and instruct personnel at site of availability and proper use.
- E. Site Enclosure Fence: At earliest reasonable date enclose project site, or portion thereof determined by Contractor to be sufficient to contain entire construction activity. Provide 6' high chain link galvanized steel fence. Provide gates for personnel and trucks, with locks held under strict security control. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Building Enclosure and Lockup: At earliest possible date, secure building against unauthorized entrance at times when personnel are not working. Provide secure temporary enclosures at ground floor and other locations of possible entry, with locked entrances. If using an outside security company to perform site observation after hours, provide the owner and program Manager with the company name, license information, contact information, resumes of persons on site and company history.
- G. Fire and Windstorm Protection: Take the following precautions to protect the project against fire and windstorm damage during construction.
- H. Set up an effective fire brigade and arrange for response to the building site by the community fire department in the event of an emergency.
- I. Provide adequate portable fire extinguisher equipment for areas of storage, construction, temporary enclosures and construction offices.
- J. Locate temporary contractor's offices, storage sheds, workmen's shanties, etc. outside of, and well detached from, the building under construction. Unless directed otherwise by the Program Manager.
- K. Installed water supplies, sprinklers, standpipes and fire hose shall closely follow completion of floors and areas.

- L. Maintain storage of combustible and flammable materials outside of (and well detached from) the buildings. Do not store combustibles inside the buildings except as indicated.
- ~~M.~~ Use only flame-proofed tarps per NFPA applicable codes.
- N. Limit the supply of flammable paints, solvents, oils, gas cylinders, etc., inside the building to that required for one day's use. Refer to the facility requirements for hot wok permits.
- O. Cutting and welding operations present a severe hazard, and such work should be done outside of the building whenever possible. Refer to the facility requirements for hot work and confined space permits.
- P. Insulation materials required for the curing of concrete shall be noncombustible.
- Q. Keep temporary electric wiring to a minimum. Flood lights are preferable to individual unprotected lamps. Install temporary electric circuits per NEC standards to prevent physical damage, and provide overload protection as specified in the National Electrical Code.
- R. Locate tar and pitch heaters (or any similar facility) outside the building, with as much detachment as possible.
- S. On-site incineration is prohibited.
- T. Maintain areas to provide ready access for the Public Fire Department.
- U. Brace all structural steel not completely installed at the end of each working day.
- V. Construct masonry walls following the erection of the permanent structural members, so that adequate lateral stability is provided.
- W. Fasten in place concrete forms
- X. Permanently secure roof decking as it is laid in place.
- Y. Permanently fasten vapor barriers, insulation and roofing materials to the roof deck as it is applied.
- Z. Adequately protect construction materials against wind damage during storage.
- AA. Securely fasten tarps or any other temporary enclosure materials.
- BB. Temporary Interruption of Fire Protection System: Implement measures per the Owners requirements for ILSM under section 01 35 23 and in compliance with all local, state and federal regulations that will maintain the integrity of the hospital fire protection during periods of impairment to such system.
- CC. Notify the Owner, Program Manager, the local fire department, and Factory Mutual one month in advance of when the fire protection will be impaired. Indicate what systems will be out of service, for how long, and what areas will be affected.

DD. Implement temporary emergency measures including: continuous roaming fire watches, discontinue any work involving cutting or welding, lay-out and charging fire hoses that can be put into operation immediately.

EE. Restore protection that is impaired as soon as possible, not allowing impairment to continue overnight or over a weekend or holiday period. Once the work is started to correct the impairment, it should be continued until the work is complete and the system restored to service.

FF. Advise previously notified parties of the restoration of service at the first opportunity.

GG. Arrange with utility company, facility representative, and existing users for time when utility services can be interrupted, if necessary, to make connections for temporary services.

2.6 TEMPORARY SUPPORT FACILITIES

- A. Temporary support facilities required include, but are not limited to, field offices, storage sheds, fabrication sheds, sanitary facilities, drinking water, first aid facilities, bulletin board, private and public telephones, clocks, thermometer, project identification signs, clean-up facilities, waste disposal service, rodent/pest control and similar miscellaneous general services, as may be reasonably required for proficient performance of the work and accommodation of personnel at the site including the Owner's and Architect's/Engineer's personnel. Discontinue and remove temporary support facilities, and make similar use of permanent work of the project, only when authorized by Architect/Engineer; and, if not otherwise indicated, immediately before time of Substantial Completion. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities. Add wireless wifi for the trailer or site office.

2.7 FIELD OFFICE

- A. Contractor's Field Office: Provide adequate office space for field office personnel plus one spare work station for incidental use by Subcontractor's personnel, suitably finished, furnished, equipped and conditioned. Where meeting space is not provided for by the Owner, include separate space for project meetings, with adequate table(s) and seating.
- B. Sanitary Facilities: At Contractor's option, provide either piped (wet) toilet facilities or self-contained toilet units of type acceptable to governing authorities, adequate (at stages of construction) for use of personnel at project site. Provide separate facilities for male and female personnel when both sexes are working (in any capacity) at project site. Provide wash facilities. Wash facilities may be wet piped or dry with hand sanitizer. Use of Owner's existing facilities will be prohibited.
- C. Drinking Water: Provide dispenser-type or electrical-power-cooled drinking water units; either piped with potable water or supplied with bottled water; adequate in number and locations for personnel at project site. Furnish paper cups and waste receptacles.
- D. Project Identification Sign: At location(s) shown on site plans, provide project identification sign as designed by the Architect and approved by the Owner. Engage an experienced sign manufacturer to paint sign. Include on the sign a picture of the Work, names of Architect, engineers, hospital, and project name. Construct sign of treated wood framing and posts, and 3/4" plywood panels of exterior type Grade B-C sanded two (2) sides. Sign shall be 8' x 8' or 8' x 16' as indicated.

- E. Warehouse for Owner-Furnished Equipment Storage: Provide a bonded insured warehouse within close proximity to the site for storage of equipment that is furnished by the Owner to be installed by the Contractor. Owner reserves the right to review and approve qualifications of warehouse. Pay costs associated with the warehouse rental, unloading and transport of equipment. Provide name, address and receiving procedures to Owner within thirty (30) days of Notice to Proceed.
- F. Telephone Service: Provide temporary telephones and service in common-use facilities for use by all construction personnel.
- G. Provide additional telephone lines for the following:
 - 1. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 - 2. Provide one (1) phone and line for the use of the Owner and others not employed by the Contractor.
- H. At each telephone, post a list of important telephone numbers.
 - 1. Police and fire departments.
 - 2. Ambulance service.
 - 3. Contractor's home office.
 - 4. Architect's office.
 - 5. Engineers' offices.
 - 6. Owner's office.
 - 7. Principal subcontractors' field and home offices.

END OF SECTION 01 50 00

SECTION 01 60 00
OWNER PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products and for use in the Project; product selection, delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

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 (BoD) Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 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. The contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors or projects if circumstances dictate.

1.4 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, see also Sections 01 50 00 and 01 74 05.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.5 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.

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/Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products
 - i. 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.
 - ii. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers
 - i. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - ii. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other

characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect/Engineer 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/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer may return requests without action, except to record noncompliance with these requirements
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 71 01

INFECTION CONTROL REQUIREMENTS

PART 1 - GENERAL

1.1 INFECTION PREVENTION MEASURES

- A. Implement the requirements of the Owner's Infection Control Risk Assessment (ICRA) team. The ICRA team may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the Contractor's infection preventive measures in accordance with the guidelines provided by ICRA team as specified herein. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the Owner and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 00, SUBMITAL PROCEDURES.
 - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical Center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality.
- D. The following preventive measures shall be adopted during construction
 - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by the Owner.
 - 2. Do not perform dust producing tasks within occupied areas without the approval of the Owner. For construction in any areas that will remain jointly occupied by the Medical Center and Contractor's workers, the Contractor shall:
 - a. Provide dust proof, appropriately fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side (see also Section 01 50 00). Install a self-closing door in a metal frame rated for the wall rating type, to allow worker access. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Owner and Medical Center.

- b. MAINTAIN NEGATIVE AIR AT ALL TIMES. Use Negative air machines and air pressure monitors, with alarms, mounted such that alarms are identifiable to the work side of the barrier. Develop procedures for work stopping when alarm sounds. Set alarms at .01" W.C. with an allowable margin for temporarily allowing changes in pressure for traffic as needed. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Ensure continuous negative air pressures occurring within the Work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. Use carpet squares around the mats to aid in dust control. USE A CHECK LIST TO MONITOR FREQUENCY OF MAT CHANGES AND CLEANING AROUND MATS. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The Contractor shall not haul debris through patient-care areas without prior approval of the Owner and the Medical Center. When approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills shall be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- 3. For existing ducts, the Contractor will cover all intake duct work that is connected to the existing facility. Any existing duct work supplying air must be under constant pressure, or be sealed when not blowing air. Supply air duct work must be protected from transient dust particles settling in the system during construction and becoming airborne when placed back into use. All new ductwork shall be protected at all ends while stored or installed on the project site.

E. Final Cleanup:

- 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
- 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
- 3. All new air ducts shall be cleaned prior to final inspection.

1.2 RISK ASSESSMENT: DEFINITIONS OF CONSTRUCTION ACTIVITY TYPES: Using the following to create the ICRA barrier types and methods.

(A COPY OF OWNERS INFECTION CONTROL RISK ASSESSMENT AND PROCEDURE IC 137 INFECTION CONTROL RISK ASSESSMENT FOLLOWS HEREIN)

END OF SECTION 01 71 01

Infection Control Risk Assessment Form

Step 1: Project Type

Using the following table, identify the type of construction project activity

TYPE A	Inspection and non-invasive activities; includes, but is not limited to: ■ removal of ceiling tiles for visual inspection only, greater than 1 tile per 50 square feet ■ painting but not sanding ■ wall covering, electrical trim work, minor plumbing, and activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
TYPE B	Small scale, short duration activities which create minimal dust; includes but is not limited to: ■ installation of telephone and computer cabling ■ access to chase spaces ■ cutting of walls or ceiling where dust migration can be controlled
TYPE C	Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies; includes but is not limited to: ■ sanding of walls for painting or wall covering ■ removal of floor coverings, ceiling tiles, and casework ■ new wall construction ■ minor ductwork or electrical work above ceilings ■ major cabling activities ■ any activity that cannot be completed within a single work shift
TYPE D	Major demolition and construction projects; includes but is not limited to: ■ activities that require consecutive work shifts ■ required heavy demolition or removal of a complete cabling system ■ new construction

Step 2: Patient Risk Group

Using the following table, identify the Patient Risk Groups that will be affected
If more than one risk group will be affected, select the higher risk group:

Low Risk	Medium Risk	High Risk	Highest Risk
■ Office areas ■ Lobby/Waiting & Patient Areas	■ Cardiology ■ Echocardiography ■ Endoscopy ■ Nuclear Medicine ■ Physical Therapy ■ Radiology/MRI ■ Respiratory Therapy	■ Coronary Care Units ■ Emergency Room ■ Labor & Delivery ■ Laboratories (specimen) ■ Newborn Nursery ■ Outpatient Surgery ■ Pediatrics ■ Pharmacy ■ Post Anesthesia Care Unit ■ Surgical Units	■ Any area caring for immunocompromised patients ■ Burn Unit ■ Cardiac Cath Lab ■ Central Sterile Supply ■ Intensive Care Units ■ Medical Unit ■ Negative pressure isolation rooms ■ Oncology ■ Operating rooms including C-section rooms

Step 3: ICRA Matrix

Use the graph below to match project type and patient risk to determine work area classification

Construction Project Type				
Patient Risk Group	TYPE A	TYPE B	TYPE C	TYPE D
LOW Risk Group	I	II	II	III/IV
MEDIUM Risk Group	I	II	III	IV
HIGH Risk Group	I	II	III/IV	IV
HIGHEST Risk Group	II	III/IV	III/IV	IV

Note: Infection Prevention approval will be required when the Construction Activity and Risk Level indicate that **Class III** or **Class IV** control procedures are necessary.

Description of Required Infection Control Precautions by Class		
	During Construction Project	Upon Completion of Project
CLASS I	1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace a ceiling tile displaced	1. Clean work area upon completion of task.
CLASS II	1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with tape. 4. Block off and seal air vents. 5. Place dust mats at entrance and exits of work areas. 6. Remove or isolate HVAC system in areas where work is being performed.	1. Wipe work surfaces with disinfectant. 2. Contain construction waste in tightly covered containers before transport. 3. Wet mop and/or vacuum with HEPA-filtered vacuum before leaving work area. 4. Upon completion, restore HVAC system where work was performed.
CLASS III	1. Remove or isolate HVAC system in area where work is being done, to prevent contamination of duct system. 2. Complete all critical barriers-for example, drywall, plywood, plastic-to seal area from nonwork area before construction begins. Or, implement control cube method with HEPA-filtered vacuum for vacuuming prior to exit. 3. Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units. 4. Contain construction waste in tightly covered containers before transport. 5. Cover transport receptacles or carts. Tape down covering unless cart has a solid lid.	1. Do not remove barriers from work area until completed project is inspected by the owner's Infection Control Department and thoroughly cleaned by the owner's Environmental Services Department. 2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 3. Vacuum work area with HEPA-filtered vacuum. 4. Wet mop area with disinfectant. 5. Upon completion, restore HVAC system where work was performed.
CLASS IV	1. Isolate HVAC system in area where work is being done, to prevent contamination of duct system. 2. Complete all critical barriers-for example, drywall, plywood, plastic-to seal area from nonwork area before construction begins. Or, implement portable cube method with HEPA-filtered vacuum for vacuuming prior to exit. 3. Maintain negative air pressure within work site utilizing HEPA- equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures. 5. Construct anteroom. Require all personnel to pass through anteroom so they can be vacuumed using a HEPA-filtered vacuum cleaner before leaving work site. Or, require all personnel to wear cloth or paper coveralls that are removed each time they leave the work site. 6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from work area until completed project is inspected by the owner's Infection Control Department and thoroughly cleaned by the owner's Environmental Services Department.	1. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction. 2. Contain construction waste in tightly covered containers before transport. 3. Cover transport receptacles or carts. Tape down covering unless cart has a solid lid. 4. Vacuum work area with HEPA-filtered vacuum. 5. Wet mop area with disinfectant. 6. Upon completion, restore HVAC system where work was performed.

Infection Control Permit						
Project Name:					Permit No:	
Location of Work:				Project Start Date:		
Project Manager:				Estimated Duration:		
Company Performing Work:				Permit Expiration Date:		
Supervisor:				Telephone:		
YES	NO	ACTIVITY	YES	NO	INFECTION CONTROL RISK GROUP	
		TYPE A: Inspection, non-invasive activity			GROUP 1: Low Risk	
		TYPE B: Small scale, short duration, moderate to high levels			GROUP 2: Medium Risk	
		TYPE C: Activity generates moderate to high levels of dust, requires greater 1 work shift for completion			GROUP 3: Medium/High Risk	
		TYPE D: Major duration and activities Requiring consecutive work shifts			GROUP 4: Highest Risk	
CLASS I		1. Execute work by methods to minimize raising dust from operations. 2. Immediately replace any ceiling tile displaced 3. Clean work area upon completion of task.				
CLASS II		1. Provides active means to prevent air-borne dust from dispersing into atmosphere 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with tape. 4. Block off and seal air vents. 5. Wipe surfaces with disinfectant. 6. Contain waste before transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA-filtered vacuum before leaving work area. 8. Place dust mat at entrance and exit of work area. 9. Isolate HVAC system in areas where work is being performed; restore when work completed.				
CLASS III		1. Obtain infection control permit before activity begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system. 3. Complete all critical barriers or implement control cube method before begins. 4. Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units. 5. Do not remove barriers from work area until complete project is inspected by owner's Infection Control Department and thoroughly cleaned by Env. Services Dept. 6. Vacuum work with HEPA-filtered vacuums. 7. Wet mop with disinfectant 8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with . 9. Contain waste before transport in tightly covered containers. 10. Cover transport receptacles or carts. Tape covering unless cart has a solid lid. 11. Upon completion, restore HVAC where work was performed.				
Date						
Initial						
Class IV		1. Obtain infection control permit before begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 3. Complete all critical barriers or implement control cube method before begins. 4. Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units. 5. Seal holes, pipes, conduits, and punctures appropriately. 6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 7. All personnel entering work site are required to wear shoe covers 8. Do not remove barriers from work area until completed project is inspected by owner's Infection Control Department and thoroughly cleaned by the Environmental Service Dept. 9. Vacuum work area with HEPA-filtered vacuums. 10. Wet mop with disinfectant. 11. Remove barrier materials carefully to minimize spreading of dirt and debris associated with . 12. Contain waste before transport in tightly covered containers. 13. Cover transport receptacles or carts. Tape covering unless cart has a solid lid. 14. Upon completion, restore HVAC system where work was performed.				
Date						
Initial						
Exceptions and/or Additional Project Requirements:						
Date Initials				Exceptions/Additions to this permit Date Initials are noted by attached memoranda.		
Permit Requested By:				Permit Authorized By:		
Date:				Date:		



TITLE: IC 137 Infection Prevention and Control Risk Assessment: Construction, Renovation, and Maintenance

PROCEDURE SUMMARY:

JPS facilities will conduct construction, renovation, and maintenance activities in such a manner as to provide a safe environment for all persons. A proactive, multidisciplinary Infection Control Risk Assessment (ICRA) will be conducted and an Infection Control (IC) Permit will be issued prior to construction, renovation or maintenance for all Class III and IV activities. Some Class II may require an ICRA after evaluation by Infection Prevention (IP).

I. PURPOSE:

- A. To institute proper infection control measures during construction, renovation or maintenance to help prevent the transmission of hospital-acquired infections (HAIs). HAIs can be transmitted by airborne dust particles created or disturbed during construction, renovation or maintenance work. Highest risk patients are those whom immune systems are suppressed or compromised (e.g. chemotherapy patients, bone marrow or organ transplants, NICU, etc.).
- B. The IPs role on the ICRA team is to assess the needs and risks of the patient population that will be affected by the construction, renovation, or maintenance activities; Address the infection prevention needs of the patients and HCP that will occupy the space after construction, renovation, or maintenance activities; And provide evidence-based guidance on infection prevention procedures to the project team.
- C. IP involvement with staff during the beginning of the project is key to identifying necessary support structures required to provide input addressing infection risks to patients, healthcare personnel, and visitors.
- D. The multidisciplinary team works together to identify the scope, timeframe, and risk of the project.

II. DEFINITIONS:

The ICRA provides a formal mechanism for evaluating and addressing

potential infection risks created by construction, renovation, and maintenance activities in healthcare facilities. The ICRA should be completed by project team lead involving representatives from Infection Prevention, Safety, Engineering, and Healthcare Professionals (HCP) who represent areas of the facility that are likely to be affected by the construction, renovation, or maintenance activities.

- A. ICRA and IC Permit: The ICRA provides a formal mechanism for evaluating and addressing potential infection risks created by construction, renovation, and maintenance activities in healthcare facilities. The IC Permit is issued once the ICRA is completed.
- B. Portable Containment Unit (HEPA Cart, Dust Buggy): A unit that incorporates the containment barrier and the negative air machine into a system that can be wheeled through a corridor and then set up at the worksite. These devices can have flexible or rigid walls. Some are clear to allow observation of the work occurring inside; others are opaque.
- C. Multidisciplinary Team: Consists of Infection Prevention and applicable project team members that may involve representatives from Design and Construction, Environment of Care and Life Safety, Clinical Engineering, Facilities Engineering, Security, Information Technology (IT), and Healthcare Professionals (HCP) who represent areas of the facility that are likely to be affected by the project/activity as required on a project by project basis.
- D. Project Manager: Individual acting on behalf of JPS for Construction, Maintenance, Renovation Activities (CMRA) managing the scope of work to be implemented. The project manager will be a representative from the department managing the project (IT, Security, Clinical Engineering, Construction, Facilities Engineering , etc)

III. PROCEDURE:

- A. Defining the scope of the work/project
 - Prior to beginning any work or demolition, a request for an IC Permit must be submitted to the Infection Prevention Department. The multidisciplinary team as determined for a given project will discuss and complete the following items:

1. Steps 1 –3 on the Infection Control Risk Assessment Form



2. Infection Control Construction Permit

B. ICRA completion

- **For projects of significant size and scope, the Project Manager must give notification at least five business days in advance to Infection Prevention in order to complete the ICRA, site walk through, and IC permit. Exceptions will be made for emergent situations.**
- C. The worksite(s) will be monitored to verify compliance with the Infection Control measures as outlined on the ICRA and IC Permit. The ICRA Project Checklist will be used by Infection Prevention to verify compliance and communicate with JPS facilities staff. The frequency of monitoring will be determined by the scope and duration of the project.
- D. Prior to receipt of permanent ID badges, contracted personnel will provide evidence of being free of active tuberculosis (TB) (e.g. TB skin or blood test), and current immunizations .
- E. Prior to receipt of temporary ID badges only, contracted personnel will complete all questions, sign, and date the Contractor Tuberculosis and Immunization Questionnaire confirming individual is free of active tuberculosis (TB) and all immunizations are up to date.

IV. PERFORMANCE REQUIREMENTS:

- A. Before any work begins, contracted personnel will attend individual department contractors orientation to become familiar with the building, break areas, restricted areas, safety precautions, required permits, emergency phone numbers, and codes.
- B. Only authorized persons should enter the work zone(s).
- C. Any contaminant identified at an active project site should be communicated immediately to the IP team and the subsequent testing results for reevaluation of IP control measures.
- D. The IC Permit should be displayed at the work area during the entire construction, renovation, or maintenance activity period.



- E. The ICRA may be revised throughout different stages of the project, as conditions warrant.

V. QUALITY CONTROL

All work may be stopped on the project whenever a hazardous infection prevention deficiency exists. Project personnel shall take immediate action to correct all deficiencies. Failure of project personnel to correct such deficiencies may result in corrective action taken.

VI. ENFORCEMENT

Project Managers (or their designee) are responsible for ensuring that the IC Permit for the project is posted and for ensuring compliance with project requirements prior to initiation of work in their areas. Any subsequent deficiency noted should be reported to the Project Manager listed on the IC Permit.

REFERENCES:

Carpenters International Training Fund. Infection Control Risk Assessment (ICRA): Construction Trades Best Practices Awareness Training. Las Vegas, NV. 2012.

Guideline for Design and Construction of Hospital and Health Care Facilities, (2010), Washington, DC: FGI Facility Guidelines Institute.

Guidelines for Environmental Infection Control in Healthcare Facilities (2003). U.S. Department of Health and Human Services Centers for Disease Control and Prevention (CDC), MMWR Vol. 52(42), 1025–6).

Johnson, L. Construction and Renovation. APIC Text of Infection Control and Epidemiology, 4th ED. Washington, DC. 2015:2652-2663.

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Vogel, R. (2015). Infection Prevention Manual for Construction & Renovation, Washington, DC: Association for Professionals in Infection Control



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Procedure #: IC 137 Infection Control Risk Assessment: Construction,
Renovation, and Maintenance
Originating Department: Infection Prevention and Control
Effective Date: 09/05/2020
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NOTES AND ATTACHMENTS:

[IC 100 Infection Control Program](#)

Contractor TB Immunization Questionnaire (Attached)

SECTION 01 72 00 COMMON EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 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 Sections include the following:
 - 1. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 - 2. Division 01 Section "Project Closeout" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit two copies signed by land surveyor.
- E. Final Property Survey: Submit two copies showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.

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

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than five days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- C. 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.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the

Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation" form included at the end of in Section 01 26 13.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish 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.
 - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
 - D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
 - E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."
- 3.5 INSTALLATION
- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, comply with provisions of Section 01 31 06. Install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.
 - 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
 - F. 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.
 - G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 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.
 - H. 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.

- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

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

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- 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: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

- I. 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.
- J. 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.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "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.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 72 00

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 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 surfaces to original conditions after installation of other Work.

1.2 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal 10 days in advance of cutting or alteration requesting approval to proceed. Include the following information
 1. Structural integrity of any element of Project.
 2. Integrity of weather-exposed or moisture-resistant element.
 3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight-exposed elements.
 5. Work of Owner or separate contractor.
 6. Include in request
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate contractor(s).
 - g. Written permission of affected separate contractor(s).
 - h. Date and time work will be executed.
 - i. List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted

PART 2 - PRODUCTS

2.1 EXISTING WARRANTIES

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

2.2 MATERIALS FOR CUTTING AND PATCHING

- A. Primary Products: Those required for original installation. Do not incorporate salvaged or used materials in new construction except with permission of Architect/Engineer.
- B. Product Substitution: For any change in materials, submit request for substitution.
- C. New Materials: As specified in individual Product Sections. Match existing products and work for patching and extending work.

- D. Decide type and quality of existing products by inspection and any necessary testing and workmanship by use of existing as standard. Presence of a product, finish, or type of work, requires that patching, extending, or matching shall be done as necessary to make Work complete and consistent with existing quality.

PART 3 - EXECUTION

3.1 EXAMINATION FOR CUTTING AND PATCHING

- A. Inspect existing conditions, prior to commencing Work, including elements subject to damage or movement during cutting and patching.
- B. After uncovering existing Work, inspect conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect/Engineer's opinion, reduce the building's aesthetic qualities. Remove and provide new construction that has been cut and patched in a visually unsatisfactory manner.

3.2 PREPARATION FOR CUTTING AND PATCHING

- A. Provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage. Provide protection from elements for areas which may be exposed by uncovering work. Maintain excavations free of water.
- B. Cut, move or remove items as necessary for access to alterations and renovation Work to proceed. Replace and restore at completion. Remove unsuitable materials not marked for salvage, such as abandoned furnishings and equipment, rotted wood, rusted metals and deteriorated masonry and concrete. Replace materials as specified for finished work.
 - 1. Unbolt bolted connections. Unscrew screw connections.
 - 2. Do not pry apart members whose finish will thereby be damaged by chipping, crazing, or cracking, or whose structural integrity will thereby be impaired.Do not remove nails from woodwork from the finished or exposed side. Drive the nails through or pull from the back so the head does not splinter the finished face.
- C. Remove debris and abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring from concealed and exposed spaces. Prepare surfaces and remove surface finishes to provide for proper installation of new work and new finishes.
- D. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting.

3.3 CUTTING AND PATCHING

- A. Execute cutting, fitting and patching including excavation and fill, to complete Work and to
 - 1. Fit the several parts together, to integrate with other work.
 - 2. Uncover work to install ill-timed work.

3. Remove defective and non-conforming work.
 4. Remove samples of installed work for testing.
 5. Provide openings in non-structural elements for penetrations of mechanical and electrical work.
 6. Repair openings in non-structural elements left by removal of mechanical and electrical work.
- B. Execute work by methods to avoid damage to other Work and which will provide proper surfaces to receive patching and finishing. Cut rigid materials using masonry or core drill. Pneumatic tools will not be allowed without prior approval.
 - C. Restore work with new products. Follow requirements of Contract Documents. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
 - D. At penetrations of smoke- and fire-rated walls, partitions, ceiling and floor construction, completely seal annular space and voids with fire-rated material, full thickness of the construction element.
 - E. At penetrations of acoustically-rated walls and partitions, completely seal annular space and voids with acoustically-rated material, full thickness of the construction element.
 - F. Cut, fit, and seal walls and partitions for chases, pipes, conduit, sleeves, grounds and other penetrations in a manner which will maintain the walls' and partitions' appearance and fire and smoke integrity. Cooperate with other Sections of work to provide correct size, shape and location of penetration as needed to maintain fire and smoke integrity.
 - G. Obtain Architect/Engineer approval prior to cutting or fitting any area not indicated where appearance, strength and integrity of work may be impaired. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, refinish entire unit.
 - H. Perform work on existing materials still under warranty in such a manner that does not void Owner's warranty. Coordinate work of alterations and renovations to expedite completion.
 - I. Perform cutting and removal work to remove minimum necessary and in a manner to avoid damage to adjacent work.
 - J. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent new finishes.
 - K. Install products as specified in individual Sections.
 - L. Inspect, repair, and/or replace existing accessible insulation within areas of renovation.
 - M. In areas of renovation, if existing lined ductwork to remain is reworked, then reseal liner seams and punctures.
 - N. Ducts that penetrate construction intended to protect against x-rays, magnetic, RFI, or other radiation shall not impair the effectiveness of the protection.
 - O. In areas of concrete slab on grade trenching, treat patched concrete infill area with a moisture vapor emissions and alkalinity control sealer capable of reducing moisture vapor emissions from up to 24 pounds before treatment and to under 3 pounds/1000 sf after treatment from the substrate.

- P. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3.4 TRANSITIONS

- A. When new Work abuts or finishes flush with existing work, make a smooth and even transition. Patched Work shall match existing adjacent Work in texture and appearance so that the patch or transition is invisible at a distance of five feet.
- B. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and provide trim appropriate to finished surface. Where new openings are cut into existing masonry walls, tooth new masonry into existing masonry.

3.5 ADJUSTMENTS

- A. Where removal of partitions results in adjacent spaces becoming one, rework floors, walls and ceilings to a smooth plane without breaks, steps, or bulkheads where shown. Where a change of plane of 1/4 inch or more occurs, request instructions from Architect/Engineer as to method of making transition.
- B. Trim existing doors as necessary to clear new floors. Refinish trim as needed for a complete installation. Fit work to penetrations of surfaces as specified in this Section.

3.6 REPAIR OF DAMAGED SURFACES

- A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections, with matching material. Repair substrate prior to patching the finish. Reconstruct streets and driveways disturbed by the Work to existing grades and in such a manner as to leave surfaces in good or better condition than before construction started.
- B. 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.
 - 1. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 2. Where items that penetrate floors and walls (such as ductwork, pipes, conduit, and similar items) are removed, patch resulting hole(s) with materials and finish(es) to match existing or as otherwise indicated.
- C. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

3.7 FINISHES

- A. Finish surfaces as specified in individual Products Sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.
- C. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

3.8 PROTECTION

- A. Protect existing finishes, equipment and adjacent work which are scheduled to remain, from damage.

END OF SECTION 01 73 29

SECTION 01 74 05

CLEANING

PART 1 - GENERAL

Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following
 1. Progress cleaning.
 2. Final cleaning.

PART 2 - PRODUCTS

2.1 SUMMARY

- 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.
- B. Do not use cleaning products containing alpha-pinene, d-limonene or other unsaturated carbon double bond alkenes.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Clean all paths of travel in the work area frequently and at the end of each shift.
 3. Do not store more than two days of materials in the work area. Materials from construction shall be stored outside the work area as allowed for in the GMP and approved by the Owner and Program Manager.
 4. Do not hold temperature and humidity sensitive materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 5. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris. Remove waste frequently during the work day and at the end of each shift of work.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work, for an OSHA compliant safe work environment, and the safe inspection thereof by the Owner and architect.

- D. Remove liquid spills promptly.
- E. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- F. 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.
- G. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- H. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- I. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- J. 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.
- K. 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.
- L. 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.
- M. Cover duct work at both ends when stored on site or installed on site.
- N. Cover plumbing lines and vents when installed.
- O. Cover medical equipment installed by any party with plastic.

3.2 FINAL CONSTRUCTION CLEANING

- A. General: Provide final construction 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 construction site and 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.
- C. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project. Apply the following items as required or projects with exterior improvements, new construction, renovations or all three.
 - 1. 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.
 - 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other

- foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 4. Remove tools, construction equipment, machinery, and surplus material from Project site.
 5. Remove snow and ice to provide safe access to building.
-
6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 8. Sweep concrete floors broom clean in unoccupied spaces.
 9. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 11. Remove labels that are not permanent.
 12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 13. Where "UL" and similar labels, including doors, frames, mechanical and electrical nameplates have been painted over, remove the paint to the original name plate.
 14. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances. Replace parts subject to unusual operating conditions.
 15. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 16. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 17. Inspect and clean as needed, ducts, blowers, and coils where new units were installed and in use during construction.
 18. Where existing mechanical systems were in use during construction, inspect and clean as needed to remove construction dust and debris.
 19. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 20. When new fixtures have been in use during construction, replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 21. Leave Project clean and ready for occupancy.

END OF SECTION 01 74 05

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging, recycling and disposing of nonhazardous demolition and construction waste.

1.2 RELATED DOCUMENTS

- A. The Contract Documents and Specifications.

1.3 DEFINITIONS

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

1.4 PERFORMANCE GOALS AND REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling by weight or volume and show to Program Manager for approval.
- B. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous demolition and construction waste as possible including the following materials:
 - 1. Deconstruction and Demolition Waste:
 - a. Asphaltic concrete paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.

- d. Brick.
- e. Concrete masonry units.
- f. Wood products.
- g. Structural and miscellaneous steel.
- h. Rough hardware.
- i. Roofing.
- j. Insulation.
- k. Doors and frames.
- l. Door hardware.
- m. Windows.
- n. Glazing.
- o. Metal studs.
- p. Gypsum board.
- q. Acoustical tile and panels.
- r. Carpet.
- s. Carpet pad.
- t. Ceramic Tile.
- u. Porcelain Tile.
- v. VCT.
- w. LVT.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panel boards.
- oo. Transformers.
- 2. Building Site Waste
 - a. Land clearing debris
 - b. Rock,
 - c. Trees,
 - d. Stumps,
 - e. Associated Vegetation,
 - f. Excavated Soils.
- 3. Construction Waste:
 - a. Site-clearing waste, including but not limited to rock, trees, stumps, and associated vegetation, and excavated soils.
 - b. Masonry and CMU.
 - c. Lumber.
 - d. Wood products.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.

- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 INFORMATIONAL SUBMITTALS

- A. The Program Manager will require a submission of the WMP AND WRWP (see section 1.7 below) regarding recycle efforts, and a report on the results of that plan at the conclusion of the project.
- B. WMP Progress Reports: ON A MONTHLY BASIS, include a report developed as part of the WMP and WRWP's for the Program Manager. Include any of the following where included in the plan:
 - a. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate if the organization is tax exempt.
 - b. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate if the organization is tax exempt.
 - c. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 - d. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
 - e. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

- C. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN (WMP)

- A. General: Create a word document consisting of items noted above in 1.4, 1.5 and 1.6 and below in sections 3.1 through 3.6, and include a section for Waste Identification and Waste Reduction as in sections B and C below. Obtain the Program Manager's approval.
- B. Waste Identification: Create a project specific word document that identifies the types of waste being created and the process for allocation for waste vs. recycling. Identify local means and methods for the process including carriers and destinations. Obtain the Program Manager's approval.
- C. Waste Reduction Work Plan (WRWP): Create a spread sheet that will list each type of waste (bricks, wood, etc.) and whether it will be salvaged, sold, recycled, and disposed of in landfill or incinerator. Identify point of origin - if unused new materials, demolition materials or site waste, total quantity of each, and handling and transportation procedures. Obtain the Program Manager's approval.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
 - 7. Do not send diverted materials to sites that are agricultural land, flood hazard areas or greenfield sites, except where such delivery is permitted by the authority having jurisdiction.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Follow the WMP and the WRWP. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator (if necessary on projects over \$10M): Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute WMP AND WRWP to all subs and vendors as part of the site training required for safety.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area [on-site] [off-site] [designated by Owner].
 - 5. Protect items from damage during transport and storage.

- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind asphalt to maximum 1-1/2-inch then break up and transport paving to asphalt-recycling facility.
 - 1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earthwork" for use as general fill.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize non-reinforced concrete to maximum 1-1/2-inch size.
 - 2. Crush concrete and screen to comply with requirements in Division 31 Section "Earthwork" for use as satisfactory soil for fill or sub-base.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 3/4-inch (19-mm) size.
 - a. Crush masonry and screen to comply with requirements in Division 31 Section "Earthwork" for use as general fill or sub-base.
 - b. Crush masonry and screen to comply with requirements in Division 32 Section "Exterior Plants" for use as mineral mulch.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.

2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: For ceiling demolition projects over 5,000 square feet, recycle brands of pulp-able mineral fiber ceiling panels and tiles per recycler's requirements.
1. Neatly, stack large, clean, dry pieces on 4'-0" x 4'-0" wood pallets. Secure and store recycle materials in a dry location. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
 2. Recycle ceiling panels and tiles except as follows:
 - a. Tiles or panels containing appreciable amounts of glue or adhesive.
 - b. Tiles with vinyl or cardboard facings.
 - c. Gypsum board tiles.
 - d. Foil backed tiles.
 - e. Wet, moldy, or weathered tiles.
 - f. Asbestos containing materials or materials installed below asbestos containing materials.
 - g. Ceiling tiles with aftermarket paint applied.
 3. Do not include any wood, metal, or other construction debris with recyclable ceiling tiles.
- I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- J. Ceramic tile, porcelain tile, VCT and LVT: separate by type and size.
- K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- L. Plumbing Fixtures: Separate by type and size.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Lighting Fixtures: Separate lamps by type and protect from breakage.
- O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panel boards, circuit breakers, and other devices by type.
- P. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
1. Comply with requirements in Division 32 Section "Exterior Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Exterior Plants" for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 32 Section "Exterior Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

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

END OF SECTION 01 74 19

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Accessibility standard inspection for compliance with Texas Accessibility Standards, ANSI A117.1, Americans with Disabilities Act Accessibility Guidelines (ADAAG) and local requirements if more stringent.
 - 3. Warranties.
 - 4. Instruction of Owner's personnel.
 - 5. Final cleaning.

1.2 SUBSTANTIAL COMPLETION

- A. "Substantial Completion" is the stage in the progress of Work when Work or designated portion thereof is sufficiently complete in accordance with Contract Documents so Owner can occupy or utilize Work for use which it is intended.
- B. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 7. Complete startup testing of systems.
 - 8. Submit test/adjust/balance records.
 - 9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 10. Advise Owner of changeover in heat and other utilities.
 - 11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 12. Complete final cleaning requirements, including touchup painting.
 - 13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- C. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 - 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report and warranty.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form, or substantially similar form, and forward to Architect at time of request for Substantial Completion inspection. Architect may use same form for Architect's supplemental items to Contractor.
 - 1. Organize list of spaces in sequential order.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.5 ACCESSIBILITY STANDARD INSPECTION

- A. Provide inspection at Substantial Completion of facility in accordance with rules and regulations of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) for the purpose of determining compliance with ADAAG. Inspector must be licensed with the state fire marshal to perform the required inspection.
- B. Upon receipt of Inspector's report, immediately make corrections of any reported non-compliant items. Provide documentation to Owner of completed corrective measures.

1.6 PROJECT RECORD DOCUMENTS

- A. Refer to Section 01 78 39.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Section 01 78 23.

1.8 WARRANTIES

- A. Submittal Time: 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.
- 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 the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch(115-by-280-mm) paper.
 - 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.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals. Refer to Section 01 78 23.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. Refer to Section 01 79 00.

3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution 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 portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Power-wash concrete paving and parking areas, and concrete decks of parking garages.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - n. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - o. Replace parts subject to unusual operating conditions.
 - p. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - q. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - r. Clean ducts, blowers, and coils if units were operated without filters during construction.

- s. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - t. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

SECTION 01 78 21 CLOSEOUT DOCUMENTS

PART 1 - GENERAL

1.1 The Owner has specific requirements for compiling and turning over closeout documentation for projects. In order to create a scalable and repeatable process, this document will serve as the requirement to the assembly of the information for submitting in electronic format. In an effort to organize information consistently during Design and Construction and into Closeout, the Uni-Format used to organize the project manual will be used to organize approved submittals and O&M manuals.

1.2 RELATED SECTION

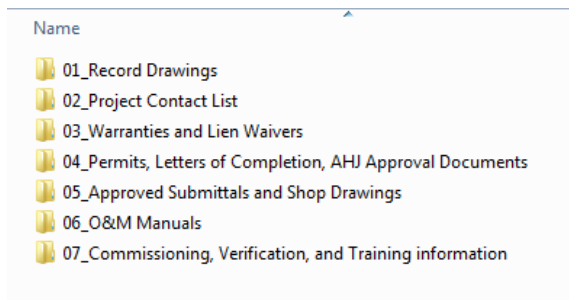
A. Section 01 78 23 – Operation and Maintenance Data for requirements for Facility Compliance Documents, Maintenance, Operating Data, Section 01 78 39 Project Record Documents and compact disk of training sessions.

PART 2 - EXECUTION

2.1 CLOSEOUT DOCUMENTS / SUBMITTALS

- A. Prior to release of retainage submit the following to the architect and the Owner's Document Administrator. Include the information in the format created by the Owner's Document Administrator and published on the Owner's project management web address for instructions to the contractor and here below. Once approved, provide electronic files to the hospital staff.
- B. Directory Structure for documents is noted below. The Contractor will follow this format when submitting close out documents for review by the architect and the Owner's Document Administrator.

The top level directories should be the following:



Below is list of the folders created for top level directories:

Name	Date modified	Type
 Division 01 — General Requirements	7/11/2013 8:49 AM	File folder
 Division 02 — Existing Conditions(natural...	7/11/2013 8:49 AM	File folder
 Division 03 — Concrete(footing)	7/11/2013 8:50 AM	File folder
 Division 04 — Masonry(concrete blockbri...	7/11/2013 8:50 AM	File folder
 Division 05 — Metals(beams)	7/11/2013 8:50 AM	File folder
 Division 06 — Wood, Plastics, and Comp...	7/11/2013 8:50 AM	File folder
 Division 07 — Thermal and Moisture Prot...	7/11/2013 8:51 AM	File folder
 Division 08 — Openings(door ways)	7/11/2013 8:51 AM	File folder
 Division 09 — Finishes	7/11/2013 8:51 AM	File folder
 Division 10 — Specialties	7/11/2013 8:51 AM	File folder
 Division 11 — Equipment	7/11/2013 8:51 AM	File folder
 Division 12 — Furnishings	7/11/2013 8:52 AM	File folder
 Division 13 — Special Construction	7/11/2013 8:52 AM	File folder
 Division 14 — Conveying Equipment	7/11/2013 8:52 AM	File folder
 Division 21 — Fire Suppression	7/11/2013 8:53 AM	File folder
 Division 22 — Plumbing	7/11/2013 8:53 AM	File folder
 Division 23 — Heating Ventilating and Ai...	7/11/2013 8:53 AM	File folder
 Division 25 — Integrated Automation	7/11/2013 8:53 AM	File folder
 Division 26 — Electrical	7/11/2013 8:53 AM	File folder
 Division 27 — Communications	7/11/2013 8:54 AM	File folder
 Division 28 — Electronic Safety and Secur...	7/11/2013 8:54 AM	File folder
 Division 31 — Earthwork	7/11/2013 8:54 AM	File folder
 Division 32 — Exterior Improvements	7/11/2013 8:54 AM	File folder
 Division 33 — Utilities	7/11/2013 8:55 AM	File folder
 Division 34 — Transportation	7/11/2013 8:55 AM	File folder
 Division 35 — Waterway and Marine	7/11/2013 8:55 AM	File folder
 Division 40 — Process Integration	7/11/2013 8:56 AM	File folder
 Division 41 — Material Processing and H...	7/11/2013 8:56 AM	File folder
 Division 42 — Process Heating, Cooling, ...	7/11/2013 8:57 AM	File folder
 Division 43 — Process Gas and Liquid Ha...	7/11/2013 8:57 AM	File folder
 Division 44 — Pollution and Waste Contr...	7/11/2013 8:58 AM	File folder
 Division 45 — Industry-Specific Manufac...	7/11/2013 8:58 AM	File folder
 Division 46 — Water and Wastewater Equ...	7/11/2013 8:58 AM	File folder
 Division 48 — Electrical Power Generation	7/11/2013 8:58 AM	File folder

C. File creation and naming convention. Submittals, Shop Drawings, and Operations and Maintenance (O&M) Manuals should be organized using subfolders for each CSI division that pertains to a project. Folders 5 Approved Submittals and Shop Drawings and 6 O&M Manuals should have the appropriate subfolders for each division.

Submittals and Shop Drawings:

File creation for submittals and shop drawings will be done per item. Name the files by Specification Section number, Submittal Number, or Shop Drawing Number, and Description. See screen shot below for example:

05 12 00 - 3 STRUCTURAL STEEL FRAMING Shop Drawings (OR-PACU) Part 1 of 2 -Approved as Noted.pdf
05 12 00 - 3 STRUCTURAL STEEL FRAMING Shop Drawings (OR-PACU) Part 2 of 2 --Approved as Noted.pdf
05 12 00 - 4 STRUCTURAL STEEL FRAMING Welding Procedure -Approved.pdf
05 12 00 - 5 STRUCTURAL STEEL FRAMING Fabricator's QA Program -Approved.pdf
05 12 00 - 6 STRUCTURAL STEEL FRAMING Fabricator Welding Certification -Approved.pdf
05 12 00 - 8 STRUCTURAL STEEL FRAMING Anchor Bolt Shop Drawings -Approved as Noted.pdf
05 12 00 - 9 STRUCTURAL STEEL FRAMING Shop Drawings (Tower Embeds) -Approved as Noted.pdf
05 31 00 - 1 (Rev 1) STEEL DECKING Shop Dwgs, PD, & Manufacturers Cert -Approved as Noted.pdf
05 31 00 - 1 STEEL DECKING Shop Drawings -Rejected.pdf
05 41 00 - 1 CF EXT STEEL STUD FRAMING Shop Dwgs, Calcs, & Manf Cert (OR & PACU) -App. as Noted.pdf
05 41 00 - 2 CF EXT STEEL STUD FRAMING Shop Dwg, Calcs, & Manf Cert (Tower) -App. as Noted.pdf
05 41 00 - 5 CF EXT STEEL STUD FRAMING Revised Hanger Spacing (OR & PACU) -Approved.pdf
05 51 00 - 4 (Rev 1) METAL STAIRS Shop Drawings -Approved as Noted.pdf
05 51 00 - 4 METAL STAIRS Shop Drawings -Revise and Resubmit.pdf
05 51 01 - 2 (Rev 1) PREFABRICATED ALUMINUM STAIR SYSTEMS Shop Drawings -Approved.pdf
05 51 01 - 2 PREFABRICATED ALUMINUM STAIR SYSTEMS Shop Drawings - Approved as Noted.pdf
05 51 01 - Stamped Calcs- File.pdf

File creation for O&M manuals will also be created by item. Name the files by specification section and description. Add the Verification Form as the first page of the O&M for each piece of equipment. See Screen shot below for example:

26 22 00 DRY TYPE TRANSFORMERS (Operation & Maintenance).pdf
26 24 13 SWITCHBOARDS (Operation & Maintenance).pdf
26 24 16 PANEL BOARDS (O&M, Spare Parts).pdf
26 24 17 ISOLATED UNGROUNDED POWER SUPPLY PANELS (Operation & Maintenance).pdf
26 32 13 EMERGENCY STANDBY ENGINE GENERATOR SYSTEM (Operation & Maintenance).pdf
26 32 13 EMERGENCY STANDBY ENGINE GENERATOR SYSTEM (Parts Manual).pdf
26 36 00 AUTOMATIC TRANSFER SWITCH (Operation & Maintenance).pdf
26 43 00 SURGE PROTECTIVE DEVICES (Operation & Maintenance).pdf
26 51_56 00 INTERIOR & EXTERIOR LIGHTING (Operation & Maintenance).pdf
26 60 01 MODULAR HEADWALL UNITS (Operation & Maintenance).pdf

2.2 CLOSEOUT DOCUMENT CHECKLIST & ORGANIZATION

Review the following items to ensure you have included them or noted where they are not necessary in your documentation to the Owner

A. Closeout Checklist

ARCHITECT

1. Record Drawings in PDF and DWG format (Architect)
2. Updated Life Safety Drawings PDF and DWG
3. EXHIBIT "J.5" G704 – CERTIFICATE OF SUBSTANTIAL COMPLETION

CONTRACTOR

1. Record Drawings
 - Project Red Line Drawings
 - Updated Asbestos Maintenance Drawing (AMD)
 - Final RFI List
 - As-Built Drawings
2. Project Contact List
 - Emergency/Project Contact List
 - EXHIBIT "J.6" G705 – LIST OF SUBCONTRACTORS
3. Warranties, Lien Waivers and Final Payment
 - Manufacture Warranties
 - Workmanship Warranties
 - EXHIBIT "J.7" G706 – CONTRACTORS AFFIDAVIT OF PAYMENT
 - EXHIBIT "J.8" G706A – CONTRACTORS AFFIDAVIT OF RELEASE OF LIENS
 - EXHIBIT "J.9" G707 – CONSENT OF SURETY TO FINAL PAYMENT
 - EXHIBIT "J.10" G707A – CONSENT OF SURETY TO REDUCTION IN RETAINAGE
4. Permits, Letters of Completion, AHJ Approval Documents
 - Permits
 - Letters of Completion
 - Owner Acceptance of Rooms with Dates Accepted
 - Fire Department Approvals
 - DOT Approvals
 - State Department of Health
5. Approved Submittals and Shop Drawings
 - Approved Shop Drawings and Submittals
 - Final Submittal List
 - Shielding Drawings
6. O&M Manuals
 - O&M Manuals
 - Parts List
7. Commissioning, Verification, and Training Documents
 - Verification Reports
 - Equipment List
 - Training Sign Off Sheets
 - Training Videos

- Med Gas Test Reports
- HVAC Test Reports (Test and Balance)
- Electrical Breaker Coordination Test Report
- Fire Suppression Test Reports
- Fire Alarm Test Reports
- Utility Test Reports
- Pressure Vessel Test Reports
- Abatement Waste Manifests

EXHIBIT "J.5" G704 - CERTIFICATE OF SUBSTANTIAL COMPLETION

EXHIBIT "J.6" G705 - LIST OF SUBCONTRACTORS

EXHIBIT "J.7" G706 - CONTRACTORS AFFIDAVIT OF PAYMENT

EXHIBIT "J.8" G706A - CONTRACTORS AFFIDAVIT OF RELEASE OF LIENS

EXHIBIT "J.9" G707 - CONSENT OF SURETY TO FINAL PAYMENT

EXHIBIT "J.10" G707A - CONSENT OF SURETY TO REDUCTION IN RETAINAGE

END OF SECTION 01 78 21

EXHIBIT “J.5”

G704 Certificate of Substantial Completion
RFP No. _____ *[Insert Project Number and Name]*

**AIA®****Document G704™ – 2017****Certificate of Substantial Completion****PROJECT:** *(name and address)***CONTRACT INFORMATION:**

Contract For:

Date:

CERTIFICATE INFORMATION:

Certificate Number:

Date:

OWNER: *(name and address)*

Tarrant County Hospital District d/b/a

JPS Health Network

1500 S. Main Street

Fort Worth, Texas 76104

Telephone Number: 817-702-4934

Fax Number: 817-702-4940

ARCHITECT: *(name and address)***CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.

(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)***SIGNATURE****PRINTED NAME AND TITLE****DATE OF SUBSTANTIAL COMPLETION****WARRANTIES**

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:

(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)***SIGNATURE****PRINTED NAME AND TITLE****DATE****OWNER** *(Firm Name)***SIGNATURE****PRINTED NAME AND TITLE****DATE**

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EXHIBIT “J.6”

G705 List of Subcontractors

RFP No. _____ *[Insert Project Number and Name]*



AIA® Document G705™ – 2001

List of Subcontractors

PROJECT: *(Name and address)*

DATE:

TO ARCHITECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

FROM CONTRACTOR: *(Name and address)*

CONTRACTOR'S PROJECT NUMBER:

(List Subcontractors and others proposed to be employed on the above Project as required by the bidding documents.)

Work/Firm Name

Address/Phone

Superintendent

EXHIBIT “J.7”

G706 Contractors Affidavit of Payment

RFP No. _____ *[Insert Project Number and Name]*

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: ☐
		ARCHITECT: ☐
TO OWNER: <i>(Name and address)</i>	CONTRACT FOR:	CONTRACTOR: ☐
Tarrant County Hospital District	CONTRACT DATED:	SURETY: ☐
d/b/a JPS Health Network		OTHER: ☐
1500 S. Main Street		
Fort Worth, Texas 76104		
Telephone Number: 817-702-4934		
Fax Number: 817-702-4940		

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☒ No

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

EXHIBIT “J.8”

G706A Contractors Affidavit of Release of Liens
RFP No. _____*[Insert Project Number and Name]*

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: ☐
		ARCHITECT: ☐
TO OWNER: <i>(Name and address)</i>	CONTRACT FOR:	CONTRACTOR: ☐
Tarrant County Hospital District d/b/a	CONTRACT DATED:	SURETY: ☐
JPS Health Network		OTHER: ☐
1500 S. Main Street		
Fort Worth, Texas 76104		
Telephone Number: 817-702-4934		
Fax Number: 817-702-4940		

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

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User Notes: (3B9ADA77)

EXHIBIT “J.9”

G707 Consent of Surety to Final Payment
RFP No. _____*[Insert Project Number and Name]*



AIA® Document G707® – 1994

Consent Of Surety to Final Payment

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
	CONTRACT DATED:	CONTRACTOR: ☐
TO OWNER: <i>(Name and address)</i>		SURETY: ☐
Tarrant County Hospital Dist.		OTHER: ☐
d/b/a JPS Health Network		
1500 S. Main Street		
Fort Worth, Texas 76104		
Telephone: 817-702-4934		
Fax Number: 817-702-4940		

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

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User Notes: (389ADA67)

EXHIBIT “J.10”

G707A Consent of Surety to Reduction in Retainage
RFP No. _____ *[Insert Project Number and Name]*



AIA® Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	CONTRACTOR: ☐
Tarrant County Hospital Dist.		SURETY: ☐
d/b/a JPS Health Network		OTHER: ☐
1500 S. Main Street		
Fort Worth, Texas 76104		
Telephone: 817-702-4934		
Fax Number: 817-702-4940		

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
 (Seal):

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 2. Divisions 02 through 28 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.4 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: 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 the 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 MANUALS, GENERAL

- 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: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
 - 6. Name and address of Architect.
 - 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.
 - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch(115-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. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. 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 diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft.(75-g/sq. m) 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.

E. Digital Media: Provide copy of manuals in Portable Document Format (.pdf)

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is 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.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

- 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.
- 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 MANUAL

- 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 the 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed 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 videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and 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 Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

This Section includes administrative and procedural requirements for transfer of the Project Record Documents **(Red Line Drawings and Specs)** from the Contractor to the Architect, including the following:

1. Record Drawings inclusive of Changes, Shop Drawings, Samples, Addenda, and contract modifications.
2. Record Specifications.

1.2 RELATED SECTIONS

Section 01 78 21 Close Out Submittals

1.3 CLOSE OUT SUBMITTALS

Record Drawings: Comply with the following:

1. Number of Copies: Electronically submit copies of Record Drawings as follows:
 - a. Initial Submittal: The Contractor shall submit marked-up Record Prints electronically on pdf. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return unacceptable pdfs with comments prints for correction and resubmittal by Contractor.
 - b. Final Submittal: Submit marked-up Record Prints, electronically via pdf. Submit pdf's of each Drawing, whether or not changes and additional information were recorded.
 - c. Submittals and Reports: Indicate items incorporated into the project record documents.

Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications, electronically via pdf.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.
 1. Preparation: Mark Record Drawings 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 prepare the 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 understandable drawing technique.

- c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing pdf; include the designation "PROJECT RECORD DRAWING" in a prominent location.

- 1. Record Prints: Organize pdfs into manageable folders.
- 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

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. Note related Change Orders and Record Drawings where applicable.

2.3 MISCELLANEOUS RECORD SUBMITTALS

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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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 videotapes.
- B. Related Sections include the following:
 - 1. Divisions 02 through 28 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including 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. At completion of training, submit two complete training manuals for Owner's use.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Demonstration and Training Videotape: Submit two copies at end of each training module.

1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Assurance Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - 1. Motorized doors.
 - 2. Equipment.
 - 3. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.
 - 4. Intrusion detection systems.
 - 5. Conveying systems, including elevators.
 - 6. Medical equipment, including medical gas equipment and piping.
 - 7. Laboratory equipment, including laboratory air and vacuum equipment and piping.
 - 8. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping and water distribution piping.
 - 9. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
 - 10. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
 - 11. HVAC instrumentation and controls.
 - 12. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
 - 13. Packaged engine generators, including transfer switches.
 - 14. Lighting equipment and controls.
 - 15. Communication systems, including intercommunication, clocks and programming, voice and data equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, with at least seven days' advance notice.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

- A. General: Engage a qualified commercial videographer to record demonstration and training sessions. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not attendee practice.
 - 1. At beginning of each training module, define learning objective and lesson outline.
- B. Video Format: Provide high-quality digital media (MP4 format)
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on video by audio narration by microphone while video is recorded, or by dubbing audio narration off-site after video is recorded. Include description of items being viewed.

END OF SECTION 01 79 00

SECTION 01 91 12

GENERAL VERIFICATION REQUIREMENTS

PART 1 - GENERAL

USE THIS SPECIFICATION ON ALL PROJECTS UNLESS DIRECTED TO USE GENERAL COMMISSIONING REQUIREMENTS BY THE PROGRAM MANAGER.

1.1 DESCRIPTION

- A. Systems Verification is the systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The systems verification process shall encompass and coordinate the traditionally separate functions of systems documentation, equipment start-up/checkout, control system calibration and point to point (PTP) checkout, testing and balancing, verification, field functional performance testing and Owner training.
- B. Additional testing shall be provided for the water quality of existing water lines that have been stagnate for more than seven (7) days before being brought into service again or if new water lines have been installed. Testing shall be performed by an environmental hygienist and a water treatment consultant. Testing shall include water borne bacteria and pathogens and for minerals and other deposits that can adversely affect either potable water quality or equipment functionality and performance.
- C. The Systems Verification program is a separate activity conducted by the architect, mechanical and electrical design engineers, and the contractors, relating primarily to mechanical and electrical systems.
- D. The Owner may elect to employ a Systems Verification Consultant. Contractor shall be responsible for coordinating with all required parties and/or the Systems Verification Consultant. Owner shall not be obligated to make the final payment to Contractor until the Systems Verification required herein are completed.

1.2 SYSTEMS TO BE VERIFIED

- A. The following new systems will require documentation verifying that they have been installed and are operating in accordance with contract documents project:
 - 1. HVAC Systems: Refer to
MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS
 - 2. Fire Alarm Systems: Refer to
ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS
 - 3. Electrical Systems: Refer to
ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS
 - 4. Fire Protection: Refer to

MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS

5. Plumbing: Refer to
MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS.
- B. The following existing systems being reused will be verified in this project
 1. HVAC Systems: Refer to
MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS
 2. Plumbing Systems: Refer to
MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS
 3. Electrical/Life Safety Systems: Refer to
ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS
 4. Pre-test Verifications of Existing Systems: Refer to
MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS
ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS

1.3 RELATED SECTIONS

- A. 01 91 12_1 - MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS
- B. 01 91 11_2 - ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 91 12

SECTION 23 08 10 – MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

1.1.1 Systems Verification is the systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The systems verification process shall encompass and coordinate the traditionally separate functions of systems documentation, equipment start-up/checkout, control system calibration and point to point (PTP) checkout, testing and balancing, verification, field functional performance testing and Owner training.

1.1.2 The mechanical contractor is responsible assuring that Systems Verification for mechanical systems is completed as directed by the general contractor.

1.2 SYSTEMS TO BE VERIFIED

1.2.1 The following new systems will require documentation provided by the mechanical contractor verifying that they have been installed and are operating in accordance with contract documents project:

1.2.1.1 HVAC Systems

- Chillers
- Pumps
- Boilers
- chilled water air handling units
- DX rooftop air handling units
- exhaust fans
- humidifiers
- condensate return units
- terminal reheat boxes (electric/hot water)
- reheat coils (electric/hot water)
- converters
- deaerators
- fan coil units
- unit heaters
- cooling tower
- split system A/C units
- chemical treatment systems
- computer room A/C units
- make-up air systems
- fuel oil pumps
- and the building automation (controls) system

1.2.1.2 FIRE PROTECTION

- Pipe Routing
- Fire alarm interlock
- Graphics
- Pump
- Flow and tamper valve interlock test

1.2.1.3 PLUMBING

- Domestic water
- Water heater/temperature
- Water and sanitary flow/pressure
- Water treatment/softener
- Circulation

1.2.2 The following existing systems being reused will be verified in this project

1.2.2.1 HVAC Systems

- Air handling units
- Chillers
- exhaust fans
- pumps

1.2.2.2 Plumbing Systems

- Medical gas line sizes
- Medical gas pumps

1.2.3 Pre-test Verifications of Existing Systems: Existing HVAC systems being reused for this project will have completed test and balance conducted by an AABC or NEBB certified contractor to establish peak capacity (water flows at coils and pumps/air flows at fans). The scope of the required test and balance services for existing systems will be specified by the design engineers. These tests will be completed prior to purchasing new equipment and materials impacted by the operation of existing systems. Pre-test reports will be provided to the design engineers and general contractor in a timely manner.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

2.1.1 All test equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances written in the Specifications. Temperature sensors, pressure sensors and digital thermometers shall have a certified calibration within the past year from the date of measurement. All testing equipment shall be calibrated according to the manufacturer's recommended intervals, and certificates shall be readily available.

PART 3 – CHECKLISTS

3.1 GENERAL

3.1.1 Pre-functional and Functional Performance checklists are included at the end of this Section.

3.1.2 All mechanical equipment and systems will have pre-functional inspection (PFI) and functional performance test (FPT) checklists completed and approved by signature of the mechanical contractor.

3.1.3 Once completed and signed, the mechanical contractor will transmit the checklist to the general contractor. The general contractor shall incorporate all completed checklists for each piece of equipment tested in the project closeout documents.

- 3.1.4 The mechanical contractor shall note on the checklist in the space provided any deviations of installed equipment from the design documents (plans and/or specifications). Deviations will be supplemented by the approved Request for Information (RFI) or correspondence received from the general contractor by the design engineer or Owner approving the deviation from design.
- 3.1.5 The checklists attached to this section contain the minimum information required for verification of each specific equipment or systems.
- 3.1.6 The mechanical contractor shall supplement the checklists where feasible with other documents provided by subcontractors or manufacturers where applicable to validate equipment operations and warranties.

PART 4 - EXECUTION

4.1 PRE-FUNCTIONAL CHECKLISTS

- 4.1.2 General: Pre-functional inspections shall ensure that the mechanical equipment and systems are installed in accordance with design documents, building codes, and manufacturer's recommendations. The pre-functional inspection shall address issues related to ease of access and maintainability.
- 4.1.3 Each piece of equipment should receive a pre-functional inspection and checkout. The pre-functional portion of each checklist is intentionally designed as a broad, high level check of the completed installation and is not intended to cover all the detailed checks necessary during the installation process or during the vendor startup required for some equipment.
- 4.1.4 The mechanical contractor shall provide additional information where necessary to supplement the pre-functional checklists provided by the A/E team; this information may include, but is not limited to, detailed checklists verifying installation in compliance with contract documents, field notes, and third party or manufacturer verifications that specific components of installed equipment have been inspected for proper installation.
- 4.1.5 The mechanical contractor shall inspect the installed equipment, date and initial each item that passes inspection. Only individuals that have direct knowledge and witnesses that a line item task on the pre-functional checklist was actually performed shall initial and date that item as complete. Upon completion of each checked item, the mechanical contractor shall notify the general contractor that items have been completed, and request an independent verification from a representative of the general contractor of completion.

4.2 FUNCTIONAL PERFORMANCE TESTS

- 4.2.1 General: The objective of the functional performance tests is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- 4.2.2 The general contractor, mechanical contractor and subcontractors shall test, witness and document the operation of each piece of mechanical equipment, date and initial each item that passes inspection.
- 4.2.3 The mechanical contractor's signature and date of completion shall validate that all HVAC control sequence of operations for that piece of equipment have been verified to be operational and calibrated. HVAC control sequence of operations shall include verification that interlocks with life

safety systems (smoke evacuation, fire alarm, smoke alarm and emergency shut offs) have been tested.

- 4.2.4 The general contractor is responsible for contacting the project architect and scheduling the design consultants and Owners Systems Verification Consultant to witness the functional performance tests. The mechanical contractor shall have appropriate staff and subcontractor personnel on site and available to provide testing of equipment and systems as directed by the design consultants and Owners Systems Verification Consultant to confirm operation. The architect, design engineers and Owners Systems Verification Consultant reserve the right to terminate the functional performance tests if in their opinion the test results indicate the systems are not operating properly.
- 4.2.5 Representatives of the architect and engineering design firm shall attest to the proper operation of equipment and/or systems by signing and dating the checklist.

VERIFICATION CHECKLIST – Air Handling Unit

General Contractor: _____

Project: _____

Subcontractor: _____

AHU No. _____

Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Motor H.P. _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design _____/actual _____			
c.	Control sequence verified			
d.	Run 24 Hour trend at 3 minutes intervals: OA Temp.: DA Temp.: Ch. Water Valve pos.; Mix Air Temp.; RA Temp. and Humidity; Supply CFM; Return CFM; OA CFM setpt.			
e.	For each AHU plot data in spreadsheet format for engineer's review			
f.	Test and Balance			
g.	Fire Alarm Interlock			
h.	Owners Acceptance/Training			GC's Initials:
				Owner's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Chiller

General Contractor: _____

Project: _____

Subcontractor: _____

Chiller No. _____

Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Capacity (Tons) _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (Tons) design_____/actual_____			
c.	Control sequence verified			
d.	Lead/lag operation verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Pumps

General Contractor: _____

Project: _____

Subcontractor: _____

Pump No. _____

System / Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

HP/GPM _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Control sequence verified			
d.	Lead/lag operation verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Exhaust Fans

General Contractor: _____ Project: _____

Subcontractor: _____

Fan No. _____ System / Area Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ CFM _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design_____/actual_____			
c.	Control sequence verified			
d.	AHU interlock verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Terminal Reheat Boxes

General Contractor: _____

Project: _____

Subcontractor: _____

Box No. _____ System / Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

CFM (Max/Min) _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Pipe/Valve Package Verified			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Control sequence verified			
b.	Run 3 minute trends: 4 hours in Htg. Mode (T ^{sat} = 76F); 4 hrs in Clg. Mode (T ^{stat} = 68F). Trend AHU DAT; Box CFM; Box DAT; HW valve pos.; damper pos.; Space set point; Space Temp.			
c.	For each box, plot data in spread sheet format for engineer's review			
d.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Boiler

General Contractor: _____

Project: _____

Subcontractor: _____

Boiler No. _____

System / Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Capacity (BHP) _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Safety Controls verified			
d.	Control sequence verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Fan Coil Units

General Contractor: _____ Project: _____

Subcontractor: _____

FCU No. _____ System / Area Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ CFM (Max/Min) _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Pipe/Valve Package verified			
c.	Electrical Services			
d.	Control Systems			
e.	Condensate trap verified			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Control sequence verified			
b.	Max Airflow (CFM) design_____/actual_____			
c.	Max Water flow (GPM) design_____/actual_____			
d.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Condensate Return Pumps

General Contractor: _____

Project: _____

Subcontractor: _____

Pump No. _____ System / Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

HP/GPM _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Control sequence verified			
d.	Lead/lag operation verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – DX Rooftop Unit

General Contractor: _____

Project: _____

Subcontractor: _____

RTU No. _____

Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Motor H.P. _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design_____/actual_____			
c.	Control sequence verified			
d.	Test and Balance			
e.	Fire Alarm Interlock			
f.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Humidifier

General Contractor: _____ Project: _____

Subcontractor: _____

Humidifier No. _____ System / Area Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ Capacity (#/hr.) _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (#/hr.) design _____/actual _____			
c.	Safety Controls verified			
d.	Control sequence verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Fire/Smoke Dampers

General Contractor: _____ Project: _____

Subcontractor: _____

Fire Damper Required Installation: _____

Smoke Damper Required Installation: _____

Combination Damper Required Installation: _____

Manufacturer, FD: _____ Model No./UL: _____

Manufacturer, SD: _____ Model No./UL: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Access Doors			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Fire Alarm interlock verified			
b.	Control sequence verified			
c.	AHU interlock verified			
d.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Split System A/C Unit

General Contractor: _____ Project: _____

Subcontractor: _____

A/C No. _____ Area Served: _____

Manufacturer (Indoor/Outdoor): _____ Model No. (Indoor): _____

Model No. (Outdoor): _____

Serial No. (Indoor/Outdoor): _____ Motor H.P. _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
e.	Condensate trap verified			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design_____/actual_____			
c.	Control sequence verified			
d.	Test and Balance			
e.	Fire Alarm Interlock			
f.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Computer Room A/C Unit

General Contractor: _____ Project: _____

Subcontractor: _____

A/C No. _____ Area Served: _____

Manufacturer (Indoor/Outdoor): _____ Model No. (Indoor): _____

Model No. (Outdoor): _____

Serial No. (Indoor/Outdoor): _____ Motor H.P. _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design_____/actual_____			
c.	Control sequence verified			
d.	Test and Balance			
e.	Fire Alarm Interlock			
f.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Cooling Tower

General Contractor: _____

Project: _____

Subcontractor: _____

Cooling Tower No. _____

Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Capacity (Tons) _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
e.	Freeze Protection verified			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Control sequence verified			
d.	Lead/lag operation verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item: _____

Attached RFI/Correspondence: _____

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Heat Exchanger

General Contractor: _____ Project: _____

Subcontractor: _____

Heat Exchanger ID _____ System Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ EAT/LAT _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Control sequence verified			
d.	Steam Pressure (psi) verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Reheat Coils

General Contractor: _____

Project: _____

Subcontractor: _____

Coil No. _____ System / Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Capacity (BTUH/KW) _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Pipe/Valve Package Verified			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Control sequence verified			
b.	Airflow (CFM) design_____/actual_____			
c.	Max flow (GPM)/elect (KW) design_____/actual_____			
d.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Deaerator

General Contractor: _____ Project: _____

Subcontractor: _____

Deaerator No. _____ System / Area Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ Capacity (BHP) _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (GPM) design_____/actual_____			
c.	Safety Controls verified			
d.	Control sequence verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Domestic Water Heater

General Contractor: _____ Project: _____

Subcontractor: _____

Water Heater No. _____ System/Service: _____

Manufacturer: _____ Model No. _____

Serial No. _____ Storage Capacity _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Hot Water Setpoint (°F) design_____/actual_____			
c.	Safety Controls verified			
d.	Control sequence verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Chemical Treatment

General Contractor: _____

Project: _____

Subcontractor: _____

System/Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Pump GPM _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Setpoint Control design_____/actual_____			
c.	Safety Controls verified			
d.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Make-up Air Unit

General Contractor: _____

Project: _____

Subcontractor: _____

MUA No. _____

Area Served: _____

Manufacturer: _____

Model No. _____

Serial No. _____

Motor H.P. _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design_____/actual_____			
c.	Control sequence verified			
d.	Test and Balance			
e.	Fire Alarm Interlock			
f.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Unit Heaters

General Contractor: _____ Project: _____

Subcontractor: _____

Unit Heater No. _____ System/Area Served: _____

Manufacturer: _____ Model No. _____

Serial No. _____ CFM (Max/Min) _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Pipe/Valve Package verified			
c.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Control sequence verified			
b.	Max Airflow (CFM) design_____/actual_____			
c.	Max Water flow (GPM) design_____/actual_____			
d.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Building Automation System

General Contractor: _____ Project: _____

Subcontractor: _____

Type (DDC, Pneumatic, etc.) _____ Area Served: _____

Manufacturer: _____ Model No. _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Airside components calibrated			
c.	Water-side components calibrated			
d.	Electrical Systems complete			
e.	Graphics verified with Installed Components			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Airside sequence verified			
c.	Water-side sequence verified			
d.	Final T&B calibration			
e.	Fire Alarm Interlock			
f.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Domestic Water Systems

General Contractor: _____ Project: _____

Subcontractor: _____

Fixture Manufacturers: _____ Area Served: _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Systems Flushed & Tested			
b.	RPBP (building service) verified			
c.	RPBP (mechanical equipment) verified			
d.	ADA access verified			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Water systems piping verified			
b.	Drainage verified			
c.	Trim and finishes verified			
d.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Medical Gas System

General Contractor: _____ Project: _____

Subcontractor: _____

Vacuum Pump:

Capacity: _____ (SCFM) Capacity: _____

Manufacturer: _____ Model No. _____

Warranty Start Date: _____ Duration: _____

Medical Air Compressor:

Capacity: _____ Pressure: _____ Flow: _____

Manufacturer: _____ Model No. _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Air compressor dryer and CO ₂ monitors installed			
c.	Vacuum Gauge and Alarm Installed			
d.	Remote Alarms Installed			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Med Gas Systems certification			
c.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Water Softener

General Contractor: _____

Project: _____

Subcontractor: _____

Manufacturer: _____

System Served: _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Access verified			
b.	Electrical/controls verified			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Water quality tests verified			
b.	Access verified			
c.	Spare media/chemicals provided			
d.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

VERIFICATION CHECKLIST – Fire Protection Systems

General Contractor: _____ Project: _____

Subcontractor: _____

State Approval Date: _____ Area Served: _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Sprinkler head type and locations verified per state approved plans			
c.	Pipe routing verified per state approved plans			
d.	Electrical/fire alarm connections complete			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Fire pump manufacturer's start-up complete			
b.	Inspector's test complete			
c.	Fire alarm graphics verified for each zone			
d.	Fire alarm interlock with flow/tamper valves verified			
e.	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

SECTION 26 08 10 – ELECTRICAL SYSTEMS VERIFICATION REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

1.1.1 Systems Verification is the systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The systems verification process shall encompass and coordinate the traditionally separate functions of systems documentation, equipment start-up/checkout, control system calibration and point to point (PTP) checkout, testing and balancing, verification, field functional performance testing and Owner training.

1.1.2 The electrical contractor is responsible assuring that Systems Verification for electrical systems is completed as directed by the general contractor.

1.2 SYSTEMS TO BE VERIFIED

1.2.1 The following new systems will require documentation provided by the electrical contractor verifying that they have been installed and are operating in accordance with contract documents project:

1.2.1.1 FIRE ALARM SYSTEMS

- Lighting
- Visual alarms
- Audio alarms
- Interlock with mechanical equipment
- Interlock with sprinkler equipment

1.2.1.2 ELECTRICAL SYSTEMS

- Panel labels
- Panel locations
- Lighting systems
- Emergency lighting systems
- Power distribution
- Transfer switch
- Cable sizes/routing
- Breaker sizes and settings
- Load verification and testing
- Random outlet testing

1.2.2 The following existing systems being reused will be verified in this project

1.2.2.1 Electrical/Life Safety Systems

- Fire alarm system

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

2.1.1 All test equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances written in the Specifications. Temperature

sensors, pressure sensors and digital thermometers shall have a certified calibration within the past year from the date of measurement. All testing equipment shall be calibrated according to the manufacturer's recommended intervals, and certificates shall be readily available.

PART 3 – CHECKLISTS

3.1 GENERAL

- 3.1.1 Pre-functional and Functional Performance checklists are included at the end of this Section.
- 3.1.2 All electrical equipment and systems will have pre-functional inspection (PFI) and functional performance test (FPT) checklists completed and approved by signature of the electrical contractor.
- 3.1.3 Once completed and signed, the electrical contractor will transmit the checklist to the general contractor. The general contractor shall incorporate all completed checklists for each piece of equipment tested in the project closeout documents.
- 3.1.4 The electrical contractor shall note on the checklist in the space provided any deviations of installed equipment from the design documents (plans and/or specifications). Deviations will be supplemented by the approved Request for Information (RFI) or correspondence received from the general contractor by the design engineer or Owner approving the deviation from design.
- 3.1.5 The checklists attached to this section contain the minimum information required for verification of each specific equipment or systems.
- 3.1.6 The electrical contractor shall supplement the checklists where feasible with other documents provided by the subcontractor or manufacturer where applicable to validate equipment operations and warranties.

PART 4 - EXECUTION

4.1 PRE-FUNCTIONAL CHECKLISTS

- 4.1.2 General: Pre-functional inspections shall ensure that the electrical equipment and systems are installed in accordance with design documents, building codes, and manufacturer's recommendations. The pre-functional inspection shall address issues related to ease of access and maintainability.
- 4.1.3 Each piece of equipment should receive a pre-functional inspection and checkout. The pre-functional portion of each checklist is intentionally designed as a broad, high level check of the completed installation and is not intended to cover all the detailed checks necessary during the installation process or during the vendor startup required for some equipment.
- 4.1.4 The electrical contractor shall provide additional information where necessary to supplement the pre-functional checklists provided by the A/E team; this information may include, but is not limited to, detailed checklists verifying installation in compliance with contract documents, field notes, and third party or manufacturer verifications that specific components of installed equipment have been inspected for proper installation.

- 4.1.5 The electrical contractor shall inspect the installed equipment, date and initial each item that passes inspection. Only individuals that have direct knowledge and witnesses that a line item task on the pre-functional checklist was actually performed shall initial and date that item as complete. Upon completion of each checked item, the electrical contractor shall notify the general contractor that items have been completed, and request an independent verification from a representative of the general contractor of completion.

4.2 FUNCTIONAL PERFORMANCE TESTS

- 4.2.1 General: The objective of the functional performance tests is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
- 4.2.2 The general contractor, electrical contractor and subcontractors shall witness and document the operation of each piece of electrical equipment, date and initial each item that passes inspection.
- 4.2.3 The general contractor is responsible for contacting the project architect and scheduling the design consultants and Owners Systems Verification Consultant to witness the functional performance tests. The electrical contractor shall have appropriate staff and subcontractor personnel on site and available to provide testing of equipment and systems as directed by the design consultants and Owners Systems Verification Consultant to confirm operation. The architect, design engineers and Owners Systems Verification Consultant reserve the right to terminate the functional performance tests if in their opinion the test results indicate the systems are not operating properly.
- 4.2.4 Representatives of the architect and engineering design firm shall attest to the proper operation of equipment and/or systems by signing and dating the checklist.

VERIFICATION CHECKLIST – Automatic Transfer Switch

General Contractor: _____ Project: _____

Subcontractor: _____

Rating/Voltage _____ Area Served: _____

Manufacturer: _____ Model No. _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the electrical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Electrical Contractor	General Contractor
a.	Physical Installation			
b.	Switchboard labels complete			
c.	Clearances confirmed			
d.	Bypass Isolation Switch verified			
FUNCTIONAL PERFORMANCE		Completion Date	Electrical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Open/Closed/Test Positions verified			
c.	Specified Time Delay for Generator Start verified			
d.	Witnessed Time Delay: _____ seconds			
	Owner Acceptance/Training			Owner's Initials: GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Fire Alarm Systems

General Contractor: _____ Project: _____

Subcontractor: _____

Manufacturer: _____ Area Served: _____

Warranty Start Date: _____ Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the electrical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Electrical Contractor	General Contractor
a.	Physical Installation			
b.	Graphics verified with installed components			
c.	Emergency lighting installed per contract documents			
d.	Exit signage verified			
FUNCTIONAL PERFORMANCE		Completion Date	Electrical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Emergency lighting systems verified			
c.	Visual alarms verified			
d.	Audio alarms verified			
e.	Fire alarm interlock with mechanical equipment verified			
f.	Fire alarm interlock with sprinkler system verified			
g.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company: _____

Signature: _____

Date: _____

Architectural Firm: _____

Signature: _____

Date: _____

VERIFICATION CHECKLIST – Electrical Systems

General Contractor: _____

Project: _____

Subcontractor: _____

Manufacturer: _____ Area Served: _____

Warranty Start Date: _____

Duration: _____

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the electrical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Electrical Contractor	General Contractor
a.	Physical Installation			
b.	Lighting systems verified with contract documents			
c.	Emergency lighting installed per contract documents			
d.	Power installed per contract documents			
FUNCTIONAL PERFORMANCE		Completion Date	Electrical Contractor	General Contractor
a.	Electrical panels and circuit breakers labeled			
b.	Emergency systems verified			
c.	Ground fault circuits verified			
d.	Load verification: Design: _____ Operating: _____			
e.	Owner Acceptance/Training			Owner's Initials:
				GC's Initials:

Deviations from Design Specifications:

Item: _____

Attached RFI/Correspondence: _____

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:

Signature:

Date:

Architectural Firm:

Signature:

Date:

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for countertops.
 - 2. Steel tube reinforcement for low partitions.
 - 3. Steel framing and supports for mechanical and electrical equipment.
 - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 5. Slotted channel framing.
 - 6. Shelf angles.
 - 7. Miscellaneous steel trim.
 - 8. Metal bollards.
 - 9. 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.

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 metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Fasteners.
 - 3. Shop primers.
 - 4. Shrinkage-resisting grout.
 - 5. Slotted channel framing.
 - 6. Metal bollards.
- 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. Provide Shop Drawings for all items listed in the summary above.
 - 1. Include shop drawings and structural analysis data signed and sealed by the qualified professional engineer licensed to practice in the location of the project, demonstrating the design and connections will meet all indicated and code required loads.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

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

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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 A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 1. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 2 (A4).
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); 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: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- F. Post-Installed Anchors: Torque-controlled expansion anchors.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, 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 F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 Section(s) on Painting
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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.
- I. Provide for anchorage of type indicated and 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. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- A. Weld shelf angle to embed plate where indicated.
- B. Galvanize and prime shelf angles located in exterior walls.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

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

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
 - 1. Cap bollards with 1/4-inch- (6.4-mm-) thick, steel plate with domed top.
- B. Prime steel bollards with zinc-rich primer.

2.10 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 bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.11 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.

2.12 BRAKE METAL

- A. Material: Galvanized steel formed in press brake.
- B. Thickness: As indicated.
- C. Finish: Field Painted.
- D. Texture: Smooth.
- E. Profile: As indicated.

2.13 GENERAL FINISH REQUIREMENTS

- 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.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
 - E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- 3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- 3.3 INSTALLATION OF METAL BOLLARDS
- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
 - C. Fill bollards solidly with concrete, mounding top surface to shed water.
- 3.4 INSTALLATION OF 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 shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- 3.5 REPAIRS
- A. Touchup Painting:
 - 1. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Painting Sections.

END OF SECTION

SECTION 061053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.
 - 3. Wood furring.
 - 4. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- 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.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- 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.
 - 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (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 D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. 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. Rooftop equipment bases and support curbs.
 - 4. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
 - 1. Mixed southern pine or southern pine; SPIB.
 - 2. Spruce-pine-fir; NLGA.
 - 3. Western woods; WCLIB or WWP A.
 - 4. Northern species; NLGA.
 - 5. Eastern softwoods; NeLMA.

- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 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 fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954, 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: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. 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, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. 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.
- 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. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- 3.2 INSTALLATION OF WOOD BLOCKING AND NAILER
- 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 INSTALLATION OF WOOD FURRING
- 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 Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.
 - C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.
- 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

SECTION 062023

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior trim, including non-fire-rated interior door and sidelight frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 DELIVERY, STORAGE, AND HANDLING

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

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install materials until building is enclosed, wet-work is completed, and HVAC system is operating and maintaining temperature and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC1.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 - 4. Do not use material that is warped or does not comply with requirements for untreated material.

5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated on Drawings.

2.3 INTERIOR TRIM

- A. Lumber Trim for Opaque Finish (Painted Finish):
 1. Species and Grade: White woods; WWPA D Select.
 2. Maximum Moisture Content: 19 percent with at least 85 percent of shipment at 12 percent or less.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).

2.4 MISCELLANEOUS MATERIALS

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

2.5 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 1. Interior standing and running trim, except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 1. Use concealed shims where necessary for alignment.
 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 1. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
 2. Stagger joints in adjacent and related standing and running trim.
 3. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 4. Use scarf joints for end-to-end joints.
 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 7. Install trim after gypsum-board joint finishing operations are completed.
 8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 9. Fasten to prevent movement or warping.
 10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

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

3.6 CLEANING

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

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 064116

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
- C. Samples for Verification: For the following:
 - 1. Plastic Laminates: 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
 - 2. Thermoset Decorative Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
 - 3. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
 - b. Miter joints for standing trim.
 - 4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of product.
 - 1. Composite wood and agrifiber products.
 - 2. Thermoset decorative panels.
 - 3. High-pressure decorative laminate.
 - 4. Adhesives.

- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Abet Laminati Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Pionite; a Panolam Industries International, Inc. brand.
 - e. Wilsonart.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: Grade HGS.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- 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.
- 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 scheduled.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013; metal.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted.
 - a. Type: Full extension.
 - b. Material: Epoxy-coated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full -extension type; zinc-plated-steel ball-bearing slides.
 - 3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2.
 - 4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.

5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 6. For computer keyboard shelves, provide Grade 1.
 7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-100.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- 2.4 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- 2.5 FABRICATION
- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings 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.
 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c..

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 architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

SECTION 066400
PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Composites, Inc.
 - b. Marlite.
 - c. Nudo Products, Inc.
 - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
 - 4. Surface Finish: Molded pebble texture.
 - 5. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

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

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyisocyanurate foam-plastic board.
 - 2. Glass-fiber blanket.
 - 3. Mineral-wool blanket.
 - 4. Mineral-wool board.

1.2 ACTION SUBMITTALS

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

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD

- A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Atlas Roofing Corporation; EnergyShield CGF Pro.
 - b. Firestone Building Products; Enverge CI Glass Faced.
 - c. Hunter Panels; Xci CG.
 - d. Rmax, Inc.; Durasheath.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; NoiseReducer Sound Attenuation and Acoustical Ceiling Batts.
 - b. Knauf Insulation; EcoBatt Unfaced with ECOSE Technology.
 - c. Owens Corning; EcoTouch PINK Fiberglas Insulation (unfaced).

2.3 MINERAL-WOOL BLANKETS

- A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Industrial Insulation Group, LLC a division of Johns Manville; TempControl Batts .
 - b. Roxul Inc.; COMFORTBATT.
 - c. Thermafiber, Inc.; an Owens Corning company; UltraBatt.

2.4 012500MINERAL-WOOL BOARD

- A. Mineral-Wool Board, Types IA and IB, Unfaced: ASTM C 612, Types IA and IB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 4 lb/cu. ft. (64 kg/cu. m).
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Industrial Insulation Group, LLC, a division of Johns Manville; JM Cladstone Water and Fire Block.
 - b. Thermafiber, Inc.; an Owens Corning company; Thermafiber RainBarrier HD.

2.5 012500INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc; Series T TACTOO Insul-Hangers.
 - b. Gemco; Spindle Type.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Gemco; 90-Degree Insulation Hangers.
 - 2. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc; RC150.
 - b. Gemco; Dome-Cap.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch (25 mm) between face of insulation and substrate to which anchor is attached.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Gemco; Clutch Clip.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc; TACTOO Adhesive.
 - b. Gemco; Tuff Bond Hanger Adhesive.

2.6 012500ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.
- D. Hexagonal Wire Mesh:
 - 1. Hot dip galvanized.
 - 2. Wire Gage: 13 mm.
 - 3. Aperture: 2-1/2 inches.

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.
- 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 CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
 - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.4 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.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 - 2. Install insulation to fit snugly without bowing.

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 PREINSTALLATION MEETINGS

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

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by firestopping manufacturer.

1.7 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.

1.8 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. Provide firestopping, including products specified in Section 078443 "Joint Firestopping," by same manufacturer as products of this section regardless of installer. All firestopping products within this section shall be of one manufacturer.
 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. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. GCP Applied Technologies Inc.
 - d. Hilti, Inc.
 - e. Johns Manville.
 - f. Nelson Firestop Products.
 - g. RectorSeal Corporation.
 - h. Specified Technologies Inc.
 - i. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - j. USG Corporation.
- 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 Horizontal Assemblies: 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: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. 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.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping 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.

2.3 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. 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.
- G. 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.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. 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. Ensure penetration firestopping products are coordinated and compatible with one another, with the substrates forming openings, and with penetrating items.
- C. 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.
 - 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.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

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.

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.

3.7 PENETRATION FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."
- D. Refer to Drawings.

END OF SECTION

SECTION 078443

JOINT FIRESTOPPING

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by firestopping manufacturer.

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.

2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint 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."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases. Provide firestopping, including products specified in Section 078413 "Penetration Firestopping," by same manufacturer as products of this section regardless of installer. All firestopping products within this section shall be of one manufacturer.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 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. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. GCP Applied Technologies Inc.
 - d. Hilti, Inc.
 - e. Johns Manville
 - f. Nelson Firestop Products.
 - g. RectorSeal Corporation.
 - h. Specified Technologies Inc.
 - i. Tremco, Inc.; Tremco Fire Protection Systems Group
 - j. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
 1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A/D Fire Protection Systems Inc.
 - b. GCP Applied Technologies Inc.
 - c. Hilti, Inc.
 - d. Johns Manville
 - e. Nelson Firestop Products.
 - f. RectorSeal Corporation.
 - g. Specified Technologies Inc.
 - h. 3M Fire Protection Products.
 - i. Tremco, Inc.; Tremco Fire Protection Systems Group
 - j. USG Corporation.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 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:
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. GCP Applied Technologies Inc.
 - d. Hilti, Inc.
 - e. Johns Manville
 - f. Nelson Firestop Products.
 - g. RectorSeal Corporation.
 - h. Specified Technologies Inc.
 - i. Tremco, Inc.; Tremco Fire Protection Systems Group
 - j. USG Corporation.
 3. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.

- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions 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: Before installing fire-resistive joint systems, clean joints immediately 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 elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill 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 joint firestopping 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.

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 elastomeric 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 elastomeric 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 elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric 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. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping 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 - Joint Firestopping - 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 joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping 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 joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

3.8 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- A. Where Intertek ETL SEMKO-listed systems are indicated, they refer to design numbers in Intertek ETL SEMKO's "Directory of Listed Building Products" under product category Firestop Systems.

3.9 FIRE-RESISTIVE JOINT SYSTEMS

- A. Refer to Drawings.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nonstaining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Mildew-resistant joint sealants.
 - 4. Butyl joint sealants.
 - 5. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

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

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. 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.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Product Certificates:
 - 1. Certifying the non-metallic plumbing piping system and the fire sprinkler piping system manufacturers evaluated and approved the joint sealant products for installation with or near its piping system.
 - 2. Certifying the joint sealant products comply with NFPA 13 requirements for material compatibility with non-metallic pipe and tubing.
- E. Field-Adhesion-Test Reports: For each sealant application tested.
- F. Sample Warranties: For special warranties.

1.5 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.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 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. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with masonry substrates.
 - 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 - 7. 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.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 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.

1.8 COORDINATION

- A. Ensure joint sealant products are coordinated and compatible with the non-metallic plumbing piping system and the fire sprinkler piping system.

1.9 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: From date of Substantial Completion.
 - a. Urethane Sealants: 10 years.
 - b. Silicone Sealants: 20 years.

- 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.
 - 1. For penetrations involving CPVC piping, provide through-penetration firestop systems which include materials that have been tested to be compatible with CPVC piping.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, 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.
 - 1. Products: 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. Dow Corning Corporation; 795 Silicone Building Sealant (VOC: 28 g/L).
 - b. GE Construction Sealants; Momentive Performance Materials Inc; SCS9000 SilPruf NB (VOC: 37 g/L).
 - c. Pecora Corporation; 864NST (VOC: <100 g/L).
 - d. Sika Corporation Industry Products; Sikasil WS-295 FPS (VOC: 37 g/L)
 - e. Tremco Inc., Tremco CS&W Group; Spectrem 2 (VOC: 42 g/L).

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Aktiengesellschaft; MasterSeal TX1 (VOC: 36 g/L).
 - b. C.R. Laurence Co, Inc.; CRL M64 (VOC: 9 g/L).
 - c. Pecora Corporation; DynaTrol I-XL (VOC: <100 g/L).
 - d. Sika Corporation Industry Products; Sikaflex Textured Sealant.
 - e. Tremco Inc., Tremco CS&W Group; Vulkem 116 (49 g/L).
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Aktiengesellschaft; MasterSeal SL 1 (VOC: 104 g/L).
 - b. Pecora Corporation; Urexpan NR-201 (VOC: <50 g/L).
 - c. Sika Corporation Industry Products; Sikaflex 1c SL (VOC: 40 g/L).
- C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. LymTal International, Inc.; Iso-Flex 888QC.

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.
- 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. 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. C.R. Laurence Co, Inc.; CRL 33S Silicone (VOC: 30 g/L).
 - b. Dow Corning Corporation; 786 Silicone Sealant (VOC: 33 g/L).
 - c. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary (VOC: 20 g/L).
 - d. Pecora Corporation; Pecora 898NST (VOC: 50 g/L).
 - e. Sika Corporation Industry Products; Sikasil GP (VOC: 29 g/L).
 - f. Soudal Accumetric; Silirub RTV1 (VOC: 30 g/L).
 - g. Tremco Inc., Tremco CS&W Group; Tremsil 200 (VOC: 1 g/L).

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C.R. Laurence Co, Inc.; CRL 777 Butyl Rubber (VOC: 240 g/L)..
 - b. Pecora Corporation; BC-158 (VOC: <250 g/L).
 - c. Tremco Inc., Tremco CS&W Group; Butyl Sealant (VOC: 232 g/L)

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 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. C.R. Laurence Co, Inc.; CRL 321 (VOC: 22 g/L).
 - b. Pecora Corporation; AC-20 (VOC: 20 g/L).
 - c. Tremco Incorporated; Tremflex 834 (VOC: 31 g/L).

2.7 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.
 - 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. Alcot Plastics Ltd.; Alcot Plastics Backer Rod.
 - b. BASF Aktiengesellschaft; MasterSeal 920.
- 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.

2.8 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting 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.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 4. Provide flush joint profile 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 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 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.

3.6 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.

3.7 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. Joints between different materials listed above.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints 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 openings.
 - g. Control and expansion joints in overhead surfaces.
 - h. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in ceramic tile flooring.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Ceramic tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of walls and partitions.
 - d. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. 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, windows, and elevator entrances.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. 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.
 - 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.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Concealed mastics.
 - 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 079219

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- 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. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 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. Franklin International; Titebond GREENchoice Professional Acoustical Smoke & Sound Sealant.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. Grabber Construction Products.
 - d. Hilti, Inc.
 - e. OSI Sealants; Henkel Corporation.
 - f. Pecora Corporation; Pecora AIS-919 Acoustical and Insulation Latex Sealant.
 - g. United States Gypsum Company; SHEETROCK Acoustical Sealant
 - 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.3 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard and custom hollow metal doors and frames.
 - 2. Steel sidelight, borrowed lite and transom frames.
 - 3. Louvers installed in hollow metal doors.
 - 4. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
 - 1. Division 01 Section "General Conditions".
 - 2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 - 5. Division 08 Section "Door Hardware".
 - 6. Division 08 Section "Access Control Hardware".
 - 7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 - 8. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
 - 9. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 - 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 - 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 - 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 - 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
 - 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 - 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
 - 14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
 - 15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
 - 16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:

1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of anchorages 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.

- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - 2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 - 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 - 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 - 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

- D. Manufacturers Basis of Design:
 - 1. Curries Company (CU) - Polystyrene Core - 707 Series.
 - 2. Curries Company (CU) - Steel-Stiffened - 747 Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – M Series.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - CM Series.
 - b. Curries Company (CU) - M Series.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 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 thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: 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.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 - 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 - 8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
 10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
 - E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- 2.10 STEEL FINISHES
- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. 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. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 1. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 3. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

FIELD QUALITY CONTROL

- D. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

SECTION 081216
ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior aluminum frames for windows installed in gypsum board partitions.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.
- B. Shop Drawings: For aluminum frames:
 - 1. Include elevations, sections, and installation details for each wall-opening condition.
 - 2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Include locations of reinforcements and preparations for hardware.
 - 4. Include details of anchorages, joints, field splices, connections, and accessories.
- C. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 PREINSTALLATION MEETING

- A. Preinstallation Conference: Conduct conference at project site.
 - 1. Review metal stud and gypsum board details and installation of aluminum frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Frameworks, Inc.; an ASSA ABLOY Group company.
 - 2. Modulux Products, Inc.
 - 3. Versatrac Frames; a division of American Door Products Inc.
 - 4. Wilson Partitions; a division of Arcadia, Inc.
- B. Source Limitations: Obtain aluminum frames from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Frames: Frames for fire-rated door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.
 - 1. Frames for Smoke- and Draft-Control Assemblies: Tested according to UL 1784 and installed in compliance with NFPA 105.
 - a. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (0.9 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa).

2.3 COMPONENTS

- A. Aluminum Framing: ASTM B 221 (ASTM B 221M), with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch (1.6 mm) thick.
- B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
- C. Glazing Frames: Extruded aluminum, for indicated glass thickness.
- D. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick; removable, snap-in casing trim and door stops, without exposed fasteners.
 - 1. Trim Style: As selected by architect.

- E. Doors: As specified in Section 081416 "Flush Wood Doors" and Section 081433 "Stile and Rail Wood Doors."
- F. Frame and Trim Finish: Clear-anodized aluminum.

2.4 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Smoke Seals: Intumescent strip or fire-rated gaskets in black.
- C. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.
- D. Glass: As specified in Section 088000 "Glazing."
- E. Door Hardware: As specified in Section 087100 "Door Hardware."

2.5 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.
- B. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- C. Fabricate components to allow secure installation without exposed fasteners.

2.6 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 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 of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.
 - 1. At fire-protection-rated openings, install fire-rated frames according to NFPA 80 and NFPA 105.
 - 2. At smoke-protection-rated openings, install smoke-rated frames according to NFPA 105.
- B. Install frame components in the longest possible lengths with no piece less than 48 inches (1220 mm); components 96 inches (2450 mm) or shorter shall be one piece.
 - 1. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 - 2. Secure clips to extruded main-frame components and not to snap-in or trim members.
 - 3. Do not leave screws or other fasteners exposed to view when installation is complete.
 - 4. Install with hairline joints.
 - 5. Puckering or warping of trim not acceptable.
- C. Glass: Install glass according to Section 088000 "Glazing" and aluminum-frame manufacturer's written instructions.

3.3 ADJUSTING

- A. Inspect installation, correct misalignments, and tighten loose connections.

- B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.
- C. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches (1220 mm) as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION

SECTION 081416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-core flush wood doors with plastic-laminate-faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
 - 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Factory-machining criteria.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 4. Dimensions and locations of blocking for hardware attachment.
 - 5. Dimensions and locations of mortises and holes for hardware.
 - 6. Clearances and undercuts.
 - 7. Requirements for veneer matching.
- C. Samples for Initial Selection: For plastic-laminate door faces.
- D. Samples for Verification:
 - 1. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.
 - 2. Polymer edging, in manufacturer's standard colors.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranties.

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C.
 - 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards." and ANSI/WDMA I.S. 1A.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

- A. Interior Doors:
 - 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. ABS-American Building Supply, Inc.; a Jeld-Wen Company.
 - b. ASSA ABLOY.
 - c. Eggers Industries.; a VT Industries Inc. Company.
 - d. Haley Brothers, Inc.
 - e. Lambton Doors.
 - f. Oshkosh Door Company.
 - g. VT Industries Inc.
 - 2. Performance Grade:
 - a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
 - b. ANSI/WDMA I.S. 1A Extra Heavy Duty: public toilets, janitor's closets, exits, and where indicated on Drawings.
 - 3. Architectural Woodwork Standards Grade: Custom.

4. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
5. Colors, Patterns, and Finishes: As scheduled .
6. Exposed Vertical and Top Edges: impact-resistant polymer edging, applied after faces.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
 - 1) Finish steel edges and astragals with baked enamel same color as doors.
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 475 lbf (2110 N) in accordance with WDMA T.M. 10.
7. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-1 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
8. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
9. Construction: Three plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces are applied.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 - 1. Install fire-rated doors and frames in accordance with NFPA 80.
 - 2. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For access doors and frames.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed 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. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. J. L. Industries; a division of Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsen's Manufacturing Company.
 - f. Milcor Inc.
 - g. Nystrom, Inc.
 - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: As indicated.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
 - 6. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, ASTM A480/A480M No. 4 finish.
 - 7. Frame Material: Same material and thickness as door.
 - 8. Latch and Lock: Cam latch, screwdriver operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Concealed 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. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. J. L. Industries; a division of Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsen's Manufacturing Company.
 - f. Milcor Inc.
 - g. Nystrom, Inc.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
 - 3. Locations: Wall.
 - 4. Door Size: As indicated.
 - 5. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
 - 7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
 - 8. Frame Material: Same material, thickness, and finish as door.
 - 9. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.6 FINISHES

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

- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 3. Run grain of directional finishes with long dimension of each piece.
 - a. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

3.5 SCHEDULE

- A. Provide access doors where indicated and in the following locations:
 - 1. Access required by code.
 - 2. Access required for servicing operable, adjustable, or resettable fire suppression, plumbing, mechanical, electrical, life safety, security, and communication systems.
- B. Sizes: Provide the following unless noted otherwise:
 - 1. Ceilings and Soffits: 24 inches by 24 inches minimum.
 - 2. Toilet Rooms: 14 inches by 14 inches minimum at each fixture chase wall.
- C. Materials:
 - 1. Uncoated steel sheet unless noted otherwise.
 - 2. Stainless Steel:
 - a. Toilet rooms, operating rooms, sterile rooms.
 - b. Walls scheduled to receive tile finish, epoxy paint, or FRP panels.

END OF SECTION

SECTION 083473.20

WOOD SLIDING DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior Aluminum-Framed, Top-Hung Sliding Wood Sound Control Door Assemblies and Related Hardware.
- B. Related Sections:
 - 1. Division 01 Section "General Conditions".
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 08 Section "Door Hardware Schedule".
 - 5. Division 08 Section "Flush Wood Doors".
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 80 - Fire Doors and Windows.
 - 4. NFPA 101 - Life Safety Code.
 - 5. NFPA 105 - Installation of Smoke Door Assemblies.
 - 6. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.
 - 7. State Building Codes, Local Amendments.

1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Refer to Division 01 Section "Project Requirements".

1.4 SUBMITTALS

- A. Comply with Division 01 Section "Submittal Procedures".
- B. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, door hardware and accessories, and finishes.
- C. Shop Drawings: Show details of fabrication and installation, including the following:
 - 1. Assembly elevations and sections indicating dimensions, tolerances, materials, components, hardware, finishes, options, and accessories.
 - 2. Door hardware locations, mounting heights, quantities, and installation requirements.
 - 3. Frame anchorages and wall reinforcement requirements.
- D. Manufacturer's Certification: Submit manufacturer's certification that assemblies comply with specified requirements and are suitable for intended application, including acoustical report as applicable.
- E. Samples for Verification: For each type of exposed finish indicated, provide samples below as requested by Architect.
 - 1. Frame finish sample.
 - 2. Door veneer sample.
- F. Maintenance Data: For top-hung, sliding door assemblies include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Notify manufacturer immediately of any shipping damage.

- C. Storage and Handling Requirements:
 - 1. Store and handle materials in accordance with manufacturer's instructions.
 - 2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
 - 3. Store materials in clean, dry area indoors.
 - 4. Protect materials and finish during storage, handling, and installation to prevent damage.

1.6 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: Manufacturer's written warranty agreeing to repair or replace components of the top-hung, sliding door assemblies that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - 4. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
 - 5. Failure of operating components to function normally.
- C. General Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Aluminum Frames: Aluminum cased opening perimeter frames manufactured with integral C-channel door cavity and acoustic seals.
- B. Closing Mechanism: Soft self-closing mechanism integrated with top track.
- C. Door Guide: Concealed type door guide.
- D. Accessibility Standards: Comply with applicable provisions in Accessibility Guidelines for Buildings and Facilities ICC (ANSI) A117.1 and requirements of authorities having jurisdiction.

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide the named product, or the comparable product by one of the alternate specified manufacturers. Comparable products are subject to review and approval through the submittal process specified.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASSA ABLOY.

2.3 INTERIOR TOP-HUNG, SLIDING SOUND CONTROL DOOR ASSEMBLIES

- A. Basis-of-Design Manufacturer:
 - 1. ASSA ABLOY RITE SLIDE Sliding Door System (RS).
- B. Frame and Door Assembly Components:
 - 1. Single Piece Box Top Track: Extruded aluminum track system with mounting brackets.
 - 2. Fascia: Extruded aluminum with matching integral end caps.
 - 3. Integral Soft-Closer: Soft and self-closing damper mechanism.
 - 4. Concealed Door Bottom Floor Guide.
 - 5. Acoustical Integrated Door Bottom.
 - 6. Seal Sets: Integral to frame.
 - 7. Operating Hardware.
- C. Specified Wall Thickness:
 - 1. As indicated on Architectural Drawings.
- D. Frame Profiles: Extruded aluminum cased frame and trim with integral vertical jamb receiver channel.
 - 1. 1-1/2" Faces.
- E. Fascia Profile:
 - 1. Standard: Square.

- F. Frame Finish:
 - 1. Standard: Clear Anodized.
- G. Framing Anchors and Fastenings: Manufacturer's standard concealed anchors and fastenings.
- H. Flush Wood Door Construction:
 - 1. Standard: WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: A Premium.
 - 2. Minimum 1-3/4" Thickness.
 - 3. Core Construction: Structural Composite Lumber (SCL). Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.
 - 4. Face Veneer: As selected by Architect.
 - 5. Finish: Comply with referenced standard for factory finishing.
- I. Door Preparation. Doors leaves to be factory machined for hardware including pilot and function holes.
- J. Door Hardware Components:
 - 1. General: Heavy-duty, operating door hardware units in sizes, quantities, and types recommended by manufacturer for sliding door assemblies indicated.
 - 2. Cylinders and Keying: Refer to Division 08 Section "Door Hardware".

2.4 FABRICATION

- A. General: Fabricate top-hung, sliding door assemblies in sizes, profiles, and configurations indicated on Architectural Schedules and Drawings.
- B. Factory prepare door assemblies for field installation of door hardware and accessories to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify dimensions of wall openings.
- B. Examine wall openings and conditions, with Installer present, for plumb, level and square, and compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Sliding door operation will be adversely affected by out-of-tolerance framing.
- C. Examine surfaces to receive door bottom guide. Floor shall have no height variance throughout the complete sliding operation.
- D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DOOR, FRAME AND HARDWARE ASSEMBLY INSTALLATION

- A. General: Comply with manufacturer's written installation instructions and approved shop drawings.
- B. Install frame components and sliding doors plumb, level, square, and in proper alignment.
- C. Anchor sliding door assemblies securely in place to supports according to manufacturer's written installation instructions.

3.3 ADJUSTING AND CLEANING

- A. Adjust sliding doors and hardware for smooth operation in accordance with manufacturer's written instructions without binding and with tight fit at contact points and seals. Sliding doors to close against walls without gaps.
- B. Repair minor damages to finish in accordance with manufacturer's written instructions and as approved by Architect.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure sliding door assemblies are without damage or deterioration at the time of Substantial Completion.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.6 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Refer to Section 087100, Door Hardware, for hardware sets.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
- C. Related Sections:
 - 1. Division 08 Section "Interior Aluminum Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.
 - 4. UL 305 - Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- F. 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.
- G. 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
- H. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 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".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.

- d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.2 SLIDING AND FOLDING HARDWARE

- A. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
 1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
 2. Manufacturers:
 - a. Pemko (PE).

2.3 POWER TRANSFER DEVICES

- A. 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. Manufacturers:

- a. McKinney (MK) - QC-C Series.

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU).
 - b. Match Existing Factory Registered Key System.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Verify existing facility key system.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. 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. Permanent Control Keys (where required): Two (2).
- E. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets – Occupancy Indicator, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML2000 Series.

2.6 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - CLX3300 Series.
- b. No Substitution.

2.7 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.

2.8 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Manufacturers:

- a. HES (HS) - 4500 Series.

- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.9 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 - 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. LCN Closers (LC) – 4040 XP Series.
 - c. No substitution.

2.10 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Rockwood (RO).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood (RO).

2.12 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 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).

2.13 ELECTRONIC ACCESSORIES

- A. Push-Button Switches: Industrial grade momentary or alternate contact, back-lighted push buttons with stainless-steel switch enclosures. 12/24 VDC bi-color illumination suitable for either flush or surface mounting.
 - 1. Manufacturers:
 - a. Alarm Controls (AK) - TS Series.
 - b. Securitron (SU) - PB Series.

2.14 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.

2.15 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RU - Corbin Russwin
4. AT - Accurate Lock and Hardware
5. HS - HES
6. RO - Rockwood
7. SU - Securitron
8. OT - Other
9. AK - Alarm Controls

Hardware Sets

Set: 1.0

Doors: 103B, 104B

Description: Access Control Function

3 Hinge, Full Mortise	TA2714 NRP (size per spec)	US26D	MK
1 Storeroom Lock	CLX3357 NZD	626C	RU
1 Electric Strike	4500C	630	HS
1 Bridge Rectifier	2005M3		HS
1 Closer	DC6200/DC6210, M77 as req'd	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
1 Door Stop	400 series as req'd	US26D	RO
3 Silencer	608 / 609 as req'd		RO
1 Wiring Harness	QC-C3000P (frame to JB/PS)		MK
1 Access Control Reader	By Security Contractor		OT
1 Shared Power Supply	By Security Contractor		SU

Notes: Verify existing key system.

Entry by valid input at reader or remote release to release electric strike. Manual key override.

Free egress at all times.

Door position switch to monitor opening status if required.

Coordinate with electrical & security contractors.

Set: 2.0

Doors: 106B, 115

Description: Access Control Function x HW Hinges

3 HW Hinge, Full Mortise	T4A3786 NRP (size per spec)	US26D	MK
1 Storeroom Lock	CLX3357 NZD	626C	RU
1 Electric Strike	4500C	630	HS
1 Bridge Rectifier	2005M3		HS
1 Closer	DC6200/DC6210, M77 as req'd	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
1 Door Stop	400 series as req'd	US26D	RO
3 Silencer	608 / 609 as req'd		RO
1 Wiring Harness	QC-C3000P (frame to JB/PS)		MK
1 Access Control Reader	By Security Contractor		OT
1 Shared Power Supply	By Security Contractor		SU

Notes: Verify existing key system.

Entry by valid input at reader or remote release to release electric strike. Manual key override.

Free egress at all times.

Door position switch to monitor opening status if required.

Coordinate with electrical & security contractors.

Set: 3.0

Doors: 102A

Description: Access Control Function (Inswing) x Call Station - Fire Rated

3 Hinge, Full Mortise	TA2714 (size per spec)	US26D	MK
1 Storeroom Lock	CLX3357 NZD	626C	RU
1 Electric Strike	4500C	630	HS
1 Bridge Rectifier	2005M3		HS
1 Closer	DC6200/DC6210, M77 as req'd	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
1 Door Stop	400 series as req'd	US26D	RO
1 Gasketing	S88		PE
1 Wiring Harness	QC-C3000P (frame to JB/PS)		MK
1 Position Switch	DPS-M-GY		SU
1 Access Control Reader	By Security Contractor		OT
1 Door Release	TS-18		AK
1 Shared Power Supply	By Security Contractor		SU

1 Call Station / Intercom	System by Others	OT
1 Wiring Diagrams	Elevation and Point-to-Point	

Notes: Verify existing key system.

Entry by valid input at reader or remote release to release electric strike. Manual key override.

Free egress at all times.

Door position switch to monitor opening status if required.

Coordinate with electrical & security contractors.

Set: 4.0

Doors: 106A

Description: Access Control Function x Call Station x HW Hinges - Fire Rated

3 HW Hinge, Full Mortise	T4A3786 NRP (size per spec)	US26D	MK
1 Storeroom Lock	CLX3357 NZD	626C	RU
1 Electric Strike	4500C	630	HS
1 Bridge Rectifier	2005M3		HS
1 Closer	DC6200/DC6210, M77 as req'd	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
1 Door Stop	400 series as req'd	US26D	RO
1 Gasketing	S88		PE
1 Wiring Harness	QC-C3000P (frame to JB/PS)		MK
1 Position Switch	DPS-M-GY		SU
1 Access Control Reader	By Security Contractor		OT
1 Door Release	TS-18		AK
1 Shared Power Supply	By Security Contractor		SU
1 Call Station / Intercom	System by Others		OT
1 Wiring Diagrams	Elevation and Point-to-Point		

Notes: Verify existing key system.

Entry by valid input at reader or remote release to release electric strike. Manual key override.

Free egress at all times.

Door position switch to monitor opening status if required.

Coordinate with electrical & security contractors.

Set: 5.0

Doors: 112

Description: Classroom Function x Closer w/ Stop x HW Hinges - Fire Rated

3 HW Hinge, Full Mortise	T4A3786 (size per spec)	US26D	MK
1 Classroom Lock	CLX3355 NZD	626C	RU

1 Closer w/ Stop	DC6210 A4 M77	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
1 Gasketing	S88		PE

Notes: Verify existing key system.

Set: 6.0

Doors: 116, 117

Description: Office Function x Coat Hook

3 Hinge, Full Mortise	TA2714 (size per spec)	US26D	MK
1 Entrance Lock	CLX3351 NZD	626C	RU
1 Door Stop	400 series as req'd	US26D	RO
3 Silencer	608 / 609 as req'd		RO
1 Coat Hook	RM811	US26D	RO

Notes: Verify existing key system.

Set: 7.0

Doors: 109

Description: Privacy Function x Closer

3 Hinge, Full Mortise	TA2314 (size per spec)	US26D	MK
1 Privacy Lock w/ Indicator	ML2030 NSA M34 V20	626C	RU
1 Closer w/ Stop	DC6210 A4 M77	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
3 Silencer	608 / 609 as req'd		RO
1 Coat Hook	RM811	US26D	RO

Set: 8.0

Doors: 102B

Description: Exit Only Function x Closer w/ Stop

3 Hinge, Full Mortise	TA2714 NRP (size per spec)	US26D	MK
1 Exit Only Latch	CLX3380 NZD	626C	RU
1 Closer w/ Stop	DC6210 A4 M77	689	RU
1 Kick Plate	K1050 10" HGT x CSK x BEV	US32D	RO
3 Silencer	608 / 609 as req'd		RO

Set: 9.0

Doors: 103A, 104A

Description: Surface Sliding Doors - Lockable from Interior

1 Side Wall Track Kit

[RF280C-SWTK](#)

PE

1 Sliding Door Lock

Accurate 9100 ADAL-5

AT

END OF SECTION 087100

SECTION 087113

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control automatic door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing automatic door operators.
- C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to the following:
 - 1. Power supplies.
 - 2. Access-control system.

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 automatic door operators.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For automatic door operators.
 - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
 - 2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Indicate locations of activation and safety devices.
 - 4. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of automatic door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Horton.
 - 2. Sargent.
 - 3. Stanley.
- B. Source Limitations: Obtain automatic door operators, including activation and safety devices, from single source from single manufacturer.

2.2 AUTOMATIC DOOR OPERATORS, GENERAL

- A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
 - 1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to automatic door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.
 - 2. 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.
 - 3. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load indicated on Drawings.
- B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.
- C. Hinges: See Section 087100 "Door Hardware" for hinge type for each door that door operator shall accommodate.
- D. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- (3.2-mm-) thick, extruded or formed aluminum; manufacturer's standard width; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- E. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

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

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Extrusions: ASTM B 221 (ASTM B 221M).
 - 2. Sheet: ASTM B 209 (ASTM B 209M).
- B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

- A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- C. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator.
 - 1. Configuration: Round push plate with 4-by-4-inch (100-by-100-mm) junction box.
 - a. Mounting: Recess mounted, semiflush in wall.
 - 2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
 - 3. Message: International symbol of accessibility and "Push to Open."
- D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.6 ACCESSORIES

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

2.7 FABRICATION

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

2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

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

3.3 ADJUSTING

- A. Adjust automatic door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for tight closure.
- B. After completing installation of automatic door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

- C. Readjust automatic door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 MAINTENANCE SERVICE

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

3.5 DEMONSTRATION

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

END OF SECTION

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for interior borrowed lites, storefront framing, and glazed curtain walls.
 - 2. Glazing sealants and accessories.

1.2 DEFINITIONS

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

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
 - 1. Insulating glass.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

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

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cardinal Glass Industries.
 - 2. Guardian Industries Corp.
 - 3. Oldcastle BuildingEnvelope™.
 - 4. McGrory Glass.
 - 5. Vitro (Formerly PPG).
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
 - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 - 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 - 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) Technoform Glass Insulation NA, Inc.
 - 2) Thermix; a brand of Ensinger USA.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Bondaflex Sil 290.
 - d. Pecora Corporation; 890NST.
 - e. Sikasil WS-290.
 - f. Tremco Incorporated; Spectrem 1
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. GE Advanced Materials - Silicones; Contractors N SCS1800.
 - c. Pecora Corporation; 864.
 - d. Polymeric Systems, Inc.; PSI-641.
 - e. Tremco Incorporated; Spectrem 2.

2.7 GLAZING TAPES

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

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

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

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Glass Type : Clear annealed float glass.
 - 1. Minimum Thickness: 6 mm.
- B. Glass Type : Clear fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

- A. Glass Type : Low-E-coated, clear insulating glass.
 - 1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 70 (2) Azuria + Clear.
 - 2. Overall Unit Thickness: 1 inch (25 mm).
 - 3. Minimum Thickness of Each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Heat-strengthened or fully tempered float glass as indicated or required by code.
 - 5. Interspace Content: Air.
 - 6. Indoor Lite: Heat-strengthened or fully tempered float glass as indicated or required by code.
 - 7. Low-E Coating: Sputtered on second surface.
 - 8. Winter Nighttime U-Factor: 0.28 maximum.
 - 9. Summer Daytime U-Factor: 0.26 maximum.
 - 10. Visible Light Transmittance: 51 percent minimum.
 - 11. Solar Heat Gain Coefficient: 0.24 maximum.
 - 12. Safety glazing required as indicated or required by code.

END OF SECTION

SECTION 088300

MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.
 - 2. Tempered glass mirrors qualifying as safety glazing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Binswanger Mirror; a division of Vitro America, Inc.
 - 2. Gardner Glass, Inc.
 - 3. Glasswerks LA, Inc.
 - 4. Guardian Industries Corp..
 - 5. Virginia Mirror Company, Inc.
 - 6. Walker Glass Co., Ltd.

- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, clear.
 - 1. Nominal Thickness: 6.0 mm.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
 - 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. Palmer Products Corporation.
 - b. Pecora Corporation.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) Laurence, C. R. Co., Inc.
 - 3) Stylmark, Inc.
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Andscot Company, Inc.
 - 2) Laurence, C. R. Co., Inc.
 - 3) Stylmark, Inc.
 - 3. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 088700
GLAZING SURFACE FILMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes film products applied to glass surfaces

1.2 DEFINITIONS

- A. Emissivity: The ability of a surface to absorb far-infrared heat and to reflect it. The lower the emissivity, the lower the far-infrared heat absorption and the greater the far-infrared heat reflectance.
- B. Low Emissivity (Low-E) Films: Films with improved far-infrared heat reflection, with the ability to reduce winter heat loss through windows. The reflection of far-infrared heat also reduces the need for summer cooling by reducing the transmission of far-infrared heat from outdoor objects through windows into the interior of a home or building.
- C. Low Reflectance Films: Films whose visible light reflectance values are very close to that of ordinary glass.
- D. Light to Solar Heat Gain Ratio: Ratio of visible light transmission to Solar Heat Gain Coefficient for a glazing system.
- E. Solar Heat Gain Coefficient: The fraction of incident solar radiation that actually passes through that window, including solar energy that is both directly transmitted and that which is absorbed and subsequently released inwardly by re-radiation and conduction.
 - 1. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits.
 - 2. This number is the mathematical complement of the TSER value: The sum of the TSER (Total Solar Energy Rejection, in decimal form) of a glazing system and its SHGC value is 1; therefore, $1 - TSER = SHGC$
- F. Fire Performance: Surface burning characteristics when applied to 1/4 inch, nominal clear glass and tested in accordance with ASTM E84:
 - 1. Flame Spread Index: 25 maximum.
 - 2. Smoke Developed: 50 maximum.
- G. Minimum Peel Strength: 2,000 grams per inch, average of two specimens when tested in accordance with ASTM D 3330.

1.3 ACTION SUBMITTALS

- A. Product Data: For each film product indicated.
- B. Samples for Color Selection: Manufacturer's standard sample sets showing the full range of colors available for each type of product indicated.
- C. Samples for Verification: 12-inch square samples of each type of glazing film specified, in color specified.
- D. Shop Drawings: Identify location for each type of film indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty: Special warranty specified in this Section.
- B. Maintenance Data and Replacement Instructions: For each type of film overlay to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.

- B. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.
 - C. Source Limitations: Obtain each type of film overlay through one source from a single manufacturer to provide products of consistent quality in appearance and physical properties.
 - D. Mockups: Apply glazing films in locations as directed to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Obtain approval of field samples before continuing with remainder of installation.
 - 2. Maintain field samples during remainder of installation in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved field samples may become part of the completed Work.
 - E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Conduct pre-installation conference in conjunction with installation of mockup.
 - 2. Meet with Owner, Architect, glazing film Installer and glazing film manufacturer's representative.
 - 3. Review methods and procedures related to installation, including manufacturer's written instructions.
 - 4. Examine substrate conditions for compliance with requirements.
 - 5. Review temporary protection measures required during and after installation.
 - 6. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - B. Store and protect glazing films according to manufacturer's written instructions and as needed to prevent damage, condensation, temperature changes, direct exposure to sun, or other causes.
- 1.8 PROJECT CONDITIONS
- A. Environmental Limitations: Do not proceed with film installation when ambient and substrate temperature conditions are outside limits permitted by manufacturer and when glass substrates are wet from frost, condensation, or other causes.
- 1.9 WARRANTY
- A. Manufacturer's Warranty: Fully executed warranty, written in favor of the Owner, agreeing to replace films that deteriorate as defined in "Definitions" Article, within 5 years from date of original installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. CPFilms Inc.; LLumar Films.
 - 2. 3M
 - 3. Solyx , SimGlas
 - 4. Huper Optik

2.2 GLAZING SURFACE FILMS

- A. Film Overlay: Single-layered applied glazing film products, applied to interior glass surfaces, consisting of the following (from outboard surface to inboard surface), as applicable to each type of film indicated:
 - 1. Removable release liner.
 - 2. Pressure sensitive adhesive with integral ultraviolet absorbers.
 - 3. Clear, dyed, or printed pattern layer of polyester film.
 - 4. Possible layer of metallized or sputtered polyester film.
 - 5. Possible scratch resistant coating.
- B. Colors: As scheduled.
- C. Basis-of-Design Product: As scheduled.

2.3 GLAZING FILM ACCESSORIES

- A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Adhesive: Pressure Sensitive acrylic adhesive system.
- C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
 - 1. Report conditions that may adversely affect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.
- C. Blade the inside surface of window glass with industrial razors to ensure removal of foreign contaminants.
- D. Protect window frames and surrounding surfaces and materials from damage during installation.

3.3 INSTALLATION

- A. General: Comply with glazing film manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements are indicated.
- B. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.
- C. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.
- D. Do not remove release liner from film until just before each piece of film is cut and ready for installation.
- E. Install film with mounting solution and custom cut to the glass with neat, square comers and edges to within 1/8 inch of the window frame.
- F. Remove air bubbles, wrinkles, blisters, and other defects.
- G. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
 - 1. If installed film does not meet this criteria, remove and replace with new film.

3.4 CLEANING

- A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.
- B. After application of film, wash film using cleaning methods recommended by glazing film manufacturer. Do not use abrasive-type cleaning agents or bristle brushes.
- C. Replace films that cannot be cleaned.

END OF SECTION

SECTION 090561.13

MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 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.

1.2 UNIT PRICES

- A. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

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. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preinstallation testing reports.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 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.

1.8 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. ARDEX Americas; ARDEX MC RAPID One-Coat Moisture Control System For Concrete to Receive ARDEX Underlayments.
 - 2. Floor Seal Technology, Inc.; MES 100.
 - 3. H.B. Fuller Construction Products Inc. / TEC; LiquiDam.
 - 4. KOSTER American Corporation; VAP I 2000 FS.
 - 5. LATICRETE SUPERCAP, LLC; LATICRETE SUPECAP Moisture Vapor Control.
 - 6. MAPEI Corporation; Planseal VS.
 - 7. Synthetics International; Synthetic30.
 - 8. USG Corporation; USG Durock Brand RH-100 Moisture Vapor Reducer.
- 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.
 - 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 hydraulic 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 200 sq. ft. (18.6 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 complying with ICRI 310.2R CSP 3 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.
- 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.
- 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

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 ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Span and Deflection Design Criteria: Provide height to load deflection charts showing studs supplied conform to deflection limit scheduled and allowed per ASTM C 754.
 - 1. Mark on chart(s) showing all major partitions scheduled conformance with criteria.
 - 2. Submit manufacturer's certification of stud size, thickness, and spacing complying with performance requirements and selections made by architect are correct for application shown.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed steel studs and tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association.

1.5 SEQUENCING

- A. Coordinate placement of concealed internal wall reinforcement, such as backing plates, for items to be attached to metal support systems.
- B. Coordinate installation of ceiling and soffit suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.
- C. Furnish concrete inserts, and other devices indicated, to other trades for installation well in advance of time needed for coordination with other construction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members" and ASTM C645, Section 10, unless otherwise indicated.
- B. 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.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Horizontal Deflection:

1. Minimum Base-Metal Thickness: 25 gage unless indicated otherwise on Drawings or below.
2. Interior Metal Stud/Gypsum Board Assemblies, Typical Locations: Withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.
3. Interior Metal Stud/Gypsum Board Assemblies at Atriums, Lobbies, Service Corridors, Exit Corridors, Elevator Lobbies, Vertical Shafts, and walls receiving plaster veneer: Withstand lateral loading (air pressure) of 7.5 psf with deflection limit not more than L/360 of partition height.
4. Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Withstand typical lateral loading (air pressure) with deflection limit not more than L/360 of partition height, minimum 20 gage studs at 16 inches on center.
5. Where wall mounted equipment, woodwork, and casework items are indicated or elsewhere as shown on Drawings, provide minimum 16 gage studs.
6. Where bumper or guard rails are indicated, provide minimum 0.033 inches (22-gage) thick studs.
7. Where security mesh is indicated, provide minimum 0.033-inch (22-gage) thick studs.
8. Where cementitious backer units are indicated, provide minimum 0.033-inch (22-gage) thick studs.
9. At jambs of openings provide two minimum 20 gage studs.
10. Ceilings: At ceilings using mold-mildew resistant gypsum framing to be 16 inches o.c. for 5/8 inch gypsum.
11. Refer to Division 05 for stud framing which is exposed to wind loads and for studs carrying heavy vertical loads, such as, cement plaster, manufactured stone masonry, stone tile thicker than 3/4 inch, etc.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 and ASTM C645 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: Comply with AISI S220 and ASTM A 653/A 653M, G40 (Z120) or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
 - a. Coating roll-formed from steel complying with mechanical and chemical requirements of ASTM A1003 with a zinc-based coating.
 - b. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction

B. Studs and Tracks: AISI S220 and ASTM C 645, Section 10 Use either steel studs and tracks or embossed steel studs and tracks.

1. Steel Studs and Tracks:
 - 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) CEMCO.
 - 2) ClarkDietrich
 - 3) Custom Stud.
 - 4) MarinoWARE.
 - 5) MBA Building Supplies.
 - 6) MRI Steel Framing, LLC.
 - 7) Phillips Manufacturing Co.
 - 8) SCAFCO Steel Stud Company.
 - 9) Steel Network, Inc. (The).
 - 10) Telling Industries
 - b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection .
 - c. Depth: As indicated on Drawings .
2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645, Section 10 steel studs and tracks.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Phillips Manufacturing Co.

- 6) SCAFCO Steel Stud Company.
 - 7) Steel Network, Inc. (The).
 - 8) Telling Industries.
 - b. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements .
 - c. Depth: As indicated on Drawings .
- C. Slip-Type Head Joints: Where studs are continuous from floor to structure above, provide one of the following:
 - 1. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. 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) BlazeFrame Industries.
 - 2) CEMCO; California Expanded Metal Products Co.
 - 3) ClarkDietrich Building Systems.
 - 4) MarinoWARE.
 - 5) MBA Building Supplies.
 - 6) Metal-Lite.
 - 7) Perfect Wall, Inc.
 - 8) SCAFCO Steel Stud Company.
 - 9) Steel Network, Inc. (The).
 - 10) Telling Industries.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. 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. BlazeFrame Industries.
 - b. CEMCO; California Expanded Metal Products Co.
 - c. ClarkDietrich Building Systems.
 - d. Fire Trak Corp.
 - e. MarinoWARE.
 - f. Metal-Lite.
 - g. Perfect Wall, Inc.
 - h. SCAFCO Steel Stud Company.
 - i. Steel Network, Inc. (The).
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich Building Systems.
 - b. MarinoWARE.
 - c. MRI Steel Framing, LLC.
 - d. SCAFCO Steel Stud Company.
 - 2. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide 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. ClarkDietrich Building Systems.
 - b. MarinoWARE.
 - c. MRI Steel Framing, LLC.
 - d. SCAFCO Steel Stud Company.
 - 2. Depth: As indicated on Drawings.
 - 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 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. ClarkDietrich Building Systems.
 - b. MarinoWARE.
 - c. MRI Steel Framing, LLC.
 - d. SCAFCO Steel Stud Company
 - 2. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
 - 3. Depth: 7/8 inch (22.2 mm).
- H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
 - 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. ClarkDietrich Building Systems.
 - b. MarinoWARE.
 - c. MRI Steel Framing, LLC.
 - d. SCAFCO Steel Stud Company
 - 2. Configuration: Asymmetrical.
- 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. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
 - 3. 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. Partial Wall Framing Connection: Connector designed to support out-of-plane loading of cantilevered partial wall systems that are unsupported at the top track.
 - 1. ClarkDietrich Pony Wall or comparable product.
 - 2. Minimum Base-Steel Thickness: 0.0966 inch (2.45 mm).

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. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor.
 - c. 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.
 - d. Material for Exterior or Interior 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. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.
- E. Carrying Channels (Main Runners): 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.
 - 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
 - 2. Steel Studs and Tracks: AISI S220 and ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
 - b. Depth: 1-5/8 inches (41 mm).

3. Embossed Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0147 inch (0.373 mm).
 - b. Depth: 1-5/8 inches (41 mm).
 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
 5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
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. Armstrong World Industries, Inc.
 - b. ROCKWOOL International (formerly Chicago Metallic Corporation).
 - c. United States Gypsum Company.
- 2.4 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install 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: As required by horizontal deflection performance requirements unless otherwise indicated.

2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
 3. Tile Backing Panels: As required by horizontal deflection performance requirements 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 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 track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (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 CEILING 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.
- 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

SECTION 092900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written 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.
 - 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. Gypsum Wallboard: ASTM C 1396/C 1396M.

- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; 5/8 inch FireBloc Type X Gypsum Wallboard.
 - b. CertainTeed Corporation; Type X Gypsum Board.
 - c. Continental Building Products, LLC; Firecheck Type X.
 - d. Georgia-Pacific Building Products; ToughRock Fireguard X Gypsum Board.
 - e. National Gypsum Company; Gold Bond Brand Fire-Shield Gypsum Board.
 - f. PABCO Gypsum; Flame Curb Type X.
 - g. United States Gypsum Company; USG Sheetrock Brand Firecode X Gypsum Panels.
 2. Thickness: 5/8 inch (15.9 mm).
 3. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; 1/2" Interior Ceiling Board.
 - b. CertainTeed Corporation; Interior Ceiling Gypsum Board.
 - c. Continental Building Products, LLC; Sagcheck.
 - d. Georgia-Pacific Building Products; ToughRock Span 24 Ceiling Board.
 - e. PABCO Gypsum; Interior Ceiling Sag-Resistant Ceiling Panel.
 - f. United States Gypsum Company; Imperial Sag-Resistant Interior Ceiling Gypsum Base.
 2. Thickness: 1/2 inch (12.7 mm).
 3. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; 5/8" M-Bloc AR Type X with Mold & Moisture Resistance.
 - b. CertainTeed Corporation; AirRenew Extreme Abuse.
 - c. Continental Building Products, Protecta AR 100 Type X with Mold Defense.
 - d. Georgia-Pacific Building Products; ToughRock Fireguard X Abuse-Resistant Gypsum Board.
 - e. National Gypsum Company; eXP Interior Extreme AR.
 - f. PABCO Gypsum; Abuse Curb.
 - g. United States Gypsum Company; USG Sheetrock Brand Mold Tough Abuse-Resistant Firecode X.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 6. Long Edges: Tapered.
 7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum ;5/8" M-Bloc Type X with Mold & Moisture Resistance.
 - b. CertainTeed Corporation; M2Tech, Type X.
 - c. Continental Building Products, LLC; Mold Defense, Type X.
 - d. Georgia-Pacific Building Products; ToughRock Mold-Guard.
 - e. National Gypsum Company; Gold Bond Brand XP Fire-Shield.
 - f. PABCO Gypsum; Mold Curb Plus, Type X.
 - g. United States Gypsum Company; USG Sheetrock Brand Mold Tough® Gypsum Panels, Type X.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum ; 1/2" FireBloc Type C Gypsum Wallboard.
 - b. CertainTeed Corporation; Type C Gypsum Board.
 - c. Continental Building Products, LLC Firecheck Type C.

- d. Georgia-Pacific Building Products ToughRock Fireguard C.
 - e. National Gypsum Company; Gold Bond Fire-Shield C.
 - f. PABCO Gypsum; Flame Curb Type Super C.
 - g. United States Gypsum Company; USG Imperial Gypsum Base, Firecode C.
- 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
- 3. Long Edges: Tapered.
- B. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Continental Building Products, LLC; Weather Defense Platinum Interior Type X.
 - b. Georgia-Pacific Building Products; DensArmour Plus.
 - c. National Gypsum Company; eXP Interior Extreme.
 - d. United States Gypsum Company; USG Sheetrock Brand Glass-Mat Panels Mold Tough.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed; SilentFX QuickCut Noise-Reducing Gypsum Board.
 - b. National Gypsum Company; 5/8" SoundBreak XP.
 - c. Quiet Solution; 1 3/8" QuietRock 545.
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed; SilentFX.
 - b. National Gypsum Company; Sound Break XP.
 - c. Quiet Solution, Quiet Rock.
 - 3. Core: 5/8 inch (15.9 mm), regular type .
 - 4. Long Edges: Tapered.

2.5 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; DiamondBack Tile Backer.
 - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 - c. National Gypsum; eXP Tile Backer.
 - d. United States Gypsum Company; USG Durock Glass-Mat Tile Backerboard.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - 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.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

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

- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
 - C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
- 2.8 AUXILIARY MATERIALS
- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
 - B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - C. 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.
 - D. Electrical Box Pads: Putty Pads: Moldable non-curing one component, intumescent, fire-rated material for through-penetration fire stop systems and sound attenuation systems; self-adhering; 1/8-inch thick minimum.
 - E. Acoustical Sealant: Refer to Section 079219 "Acoustical Joint Sealants."
 - F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- 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 ELECTRICAL BOX PADS FOR SMOKE / FIRE-RATED AND STC-RATED WALLS

- A. Prior to installing wallboards, install electrical box pads in accordance with manufacturer's written instructions.
- B. Overlap front edge of box so that pad will be compressed around edges of box as gypsum panels are installed.

3.3 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.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces except at fire rated ceilings, then use Type X.
 - 3. Abuse-Resistant Type: As indicated on Drawings.
 - 4. Mold-Resistant Type: As indicated on Drawings.
 - 5. Glass-Mat Interior Type: As indicated on Drawings and the following.
 - a. Interior side of exterior walls.
 - b. Interior partitions where Contractor chooses to install gypsum board prior to building dry-in.
 - c. On tile walls, unless noted otherwise.
 - d. At urinal and toilet fixtures as indicated on Drawings.
 - 6. Tile Backer, Glass-Mat Type:
 - a. Walls in toilet room with shower.
 - b. Tiled walls in showers and bathtubs.
 - c. Tiled walls in toilet rooms and kitchens.
 - d. Behind prefabricated shower or bathtub units.
 - 7. Acoustically Enhanced 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. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
1. Do not install screws within 6 inches of the shower wall base so as to not penetrate shower pan waterproofing.
- 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 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. Bullnose Bead: Use where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

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, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile.
 3. Level 3: Where indicated on Drawings.
 4. Level 4: At panel surfaces that will be exposed to view and areas scheduled to receive wall coverings unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.8 RATED PARTITION IDENTIFICATION

- A. At fire-rated wall and smoke partition assemblies, provide an identification of wall rating in 4-inch high stenciled block letters in red paint. Space identifications 12 feet on center maximum, 4 feet from corners maximum, above ceiling. Provide identification on both sides of wall.
- B. Partition Identification Text: Apply the following, as applicable:
1. WARNING: SMOKE PARTITION – PROPERLY SEAL ALL OPENINGS.
 2. WARNING: 1-HOUR SMOKE BARRIER – PROPERLY SEAL ALL OPENINGS.
 3. WARNING: 1-HOUR FIRE PARTITION – PROPERLY SEAL ALL OPENINGS.
 4. WARNING: 1-HOUR FIRE BARRIER – PROPERLY SEAL ALL OPENINGS.
 5. WARNING: 2-HOUR FIRE WALL – PROPERLY SEAL ALL OPENINGS.
 6. WARNING: 2-HOUR FIRE BARRIER – PROPERLY SEAL ALL OPENINGS.
- C. Refer to Section 099123 "Interior Painting" for painting requirements.
1. Use interior semi-gloss, latex, low VOC paint.

3.9 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before installing gypsum board ceilings, conduct an above-ceiling inspection, and report and correct deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for Contractor's above-ceiling inspection. Provide Architect with copy of deficiencies report. Architect reserves the right to supplement Contractor's deficiency report with other incomplete or incorrect items that might be observed during Architect's site visit.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.
 - g. Touch-up/patching of spray fire-resistive materials (SFRM).
 - h. Installation of penetration firestopping in fire- and smoke-rated partitions.
 - i. Installation of fire-resistant joint sealants in fire-rated partitions.
 - j. Installation of acoustical sealants at adjacent sound-rated partitions.
 - a. Application of fire- and smoke-rated partition identification.

3.10 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

SECTION 093013

CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile.
 - 2. Glazed wall tile.
 - 3. Waterproof membrane for thinset applications.
 - 4. Crack isolation membrane.
 - 5. Metal edge strips.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, ANSI A108.17, and ANSI A108.19 which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.
- E. Large format gauged porcelain tiles are 8 mm or less in thickness, and having a face dimension up to 60 inches wide and 118 inches long.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
 - 4. Metal edge strips in 6-inch (150-mm) lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
 - 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
 - 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
 - 4. the U.S. Department of Labor as Journeyman Tile Layers.
 - 5. Installer of large format gauged porcelain tile panels shall have completed advanced certification training (ACT)
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of each type of floor tile installation.
 - 2. Build mockup of each type of wall tile installation.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.10 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of tile system that fail in materials or workmanship within specified warranty period, when the products are installed within their shelf life and according to governmental regulations and manufacturer's written materials which are in effect at the time installation.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Waterproof membrane.
 - 2. Crack isolation membrane.
 - 3. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 (and A137.3 for large format tiles) for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Dynamic Coefficient of Friction (level interior tiles that will be walked on when wet) per ANSI A137.1: DCOF (Dynamic Coefficient of Friction) of 0.42, DCOF, per DCOF AcuTestSM method.
- F. Large format gauged porcelain tiles shall meet material and installation standards of ANSI A137.3 Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

2.3 TILE PRODUCTS

- A. As Scheduled.

2.4 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Noble Company (The);Nobleseal TS.
 - 2. Nominal Thickness: 0.030 inch (0.76 mm), minimum.
- C. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.2-mm) nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Schluter Systems L.P.; KERDI.
- D. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - b. H.B. Fuller Construction Products Inc. / TEC; Hydraflex Waterproofing Crack Isolation Membrane with Waterproofing Mesh.
 - c. LATICRETE SUPERCAP, LLC; Laticrete 9235 Waterproof Membrane.
 - d. MAPEI Corporation; Fiberglass Mesh with Mapelastic Waterstop.

2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Noble Company (The); Nobleseal CIS.
 - b. Mapei Corporation Mapeguard 2,
- C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - b. H.B. Fuller Construction Products Inc. / TEC; Hydraflex Waterproofing Crack Isolation Membrane.
 - c. LATICRETE SUPERCAP, LLC; Laticrete 9235 Waterproof Membrane.
 - d. MAPEI Corporation; Mapelastic CI.

2.6 SETTING MATERIALS

- A. Medium-Bed (Large and Heavy Tile), Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4, A118.11, and ISO13007 C2TES1P1. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Marble, Granite & Travertine Premium Medium Bed Mortar.
 - b. H.B. Fuller Construction Products Inc. / TEC TEC Ultimate Large Tile Mortar TA 382 / 383.
 - c. LATICRETE SUPERCAP, LLC; 4-XLT.
 - d. MAPEI Corporation; Ultraflex LFT.
- B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15, A118.11, and ISO 13007 C2ES1P1.
 - 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. Custom Building Products; Megaflex Crack Prevention Mortar.
 - b. H.B. Fuller Construction Products Inc. / TEC; Ultimate 6 Plus Mortar
 - c. LATICRETE SUPERCAP, LLC; LATICRETE® SUPERCAP™ Moisture Vapor Control.
 - d. MAPEI Corporation; Floor Tile Mortar.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.7 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6, unsanded.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Polyblend Non-Sanded.
 - b. H.B. Fuller Construction Products Inc. / TEC; AccuColor Premium Unsanded Grout.
 - c. LATICRETE SUPERCAP, LLC; 1600 Unsanded Grout.
 - d. MAPEI Corporation; Keracolor U.
- B. Standard Cement Grout: ANSI A118.6, sanded.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Polyblend Sanded.
 - b. H.B. Fuller Construction Products Inc. / TEC; AccuColor Sanded Grout.
 - c. LATICRETE SUPERCAP, LLC; 1500 Sanded Grout.
 - d. MAPEI Corporation; Keracolor S.
- C. High-Performance Tile Grout: ANSI A118.7 and ISO 13007 CG2FAW.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Prism Color Consistent Grout.
 - b. H.B. Fuller Construction Products Inc. / TEC; TEC Power Grout.
 - c. LATICRETE SUPERCAP, LLC; Permacolor.
 - d. MAPEI Corporation; Ultracolor Plus.
 - 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
- D. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; CEG Lite 100% Solids Commercial Epoxy Grout.
 - b. H.B. Fuller Construction Products Inc. / TEC; AccuColor EFX Epoxy Special Effects Grout.

- c. LATICRETE SUPERCAP, LLC; SpectraLOCK Pro Premium.
 - d. MAPEI Corporation; Kerapoxy CQ.
 - 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.
 - E. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.
- 2.8 MISCELLANEOUS MATERIALS
- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
 - B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
 - 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. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.
 - c. Schluter Systems L.P.
 - C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
 - D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout as approved by grout manufacturer.
- 2.9 MIXING MORTARS AND GROUT
- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - B. Add materials, water, and additives in accurate proportions.
 - C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/16 inch (1.6 mm) unless scheduled otherwise.
 - 2. Porcelain Tile: 1/4 inch (6.4 mm) unless scheduled otherwise.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry-set mortar (thinset).
 - 2. Do not extend waterproofing or crack isolation membrane under thresholds set in improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.
- K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- L. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Ceramic Tile Installation: TCNA F113; thinset mortar.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance sanded grout.
 - 2. Ceramic Tile Installation: TCNA F115; thinset mortar; epoxy grout.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: Water-cleanable epoxy grout.
 - 3. Ceramic Tile Installation: TCNA F122; thinset mortar on waterproof membrane.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance sanded grout.
 - 4. Ceramic Tile Installation: TCNA F125-Full; thinset mortar on crack isolation membrane.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance sanded grout.
 - 5. Large Format Gauged Porcelain Tile Panels:
 - a. Mortar: Medium bed modified dry-set mortar.
 - b. Grout: High-performance sanded grout.
- B. Interior Wall Installations, Masonry or Concrete:
 - 1. Ceramic Tile Installation: TCNA W202; thinset mortar.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance unsanded grout.

- C. Interior Wall Installations, Wood or Metal Studs or Furring:
1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance unsanded grout.
 2. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
 - a. Ceramic Tile Type: As scheduled.
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance unsanded grout.
 3. Large Format Gauged Porcelain Tile Panels:
 - a. Mortar: Medium bed modified dry-set mortar.
 - b. Grout: High-performance unsanded grout.

END OF SECTION

SECTION 095113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Samples of each type, color, pattern, and texture in manufacturer's standard sample size, minimum 6 inches square.

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. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 - 7. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

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

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. Acoustical Ceiling Units: Full-size panels equal to 2percent 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 2percent of quantity installed.

1.6 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: Class A according to ASTM E 1264.
 2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Armstrong World Industries, Inc.
 2. CertainTeed Corp.
 3. Rockfon (Roxul, Inc.)
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Panels: As scheduled.

2.4 METAL SUSPENSION 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. Armstrong World Industries, Inc.
 2. CertainTeed Corp.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
- C. 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, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 1. Structural Classification: Intermediate -duty system.
 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 3. Face Design: Flat, flush.
 4. Cap Material: Cold-rolled steel or aluminum.
 5. Cap Finish: Painted white.

- D. Narrow-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, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
 - 1. Structural Classification: Intermediate -duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Cold-rolled steel or aluminum.
 - 5. Cap Finish: Painted white.
- E. Extra-Wide-Face, Double -Web, Metal Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with 1-1/2-inch- (38-mm-) wide flanges.
 - 1. Structural Classification: Intermediate -duty system.
 - 2. Face Design: Flat, flush.
 - 3. Face Finish: Painted white.
 - 4. Gasket System: Clean-room type.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for 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 not less than 0.106-inch- (2.69-mm-) diameter wire.
- C. Hold-Down Clips: Manufacturer's standard hold-down.
- D. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

2.6 METAL EDGE MOLDINGS AND TRIM

- 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. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. Chicago Metallic Corporation.
 - 4. Fry Reglet Corporation.
 - 5. Gordon, Inc.
 - 6. United States Gypsum Company.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- 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 to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. 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.
- 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. 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. Miter corners accurately and connect securely.
 - 2. 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 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. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. 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.
6. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - a. Hold-Down Clips: Space 24 inches (610 mm) o.c. on all cross runners.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

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.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096116
CONCRETE FLOOR SEALING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Sealing of concrete floor areas not otherwise scheduled to receive finish floor covering.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include data to indicate chemical, solvent, and detergent resistance.
 - 2. Include information for primer, sealants, accessories and other required components.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fluid-applied floor sealer to include in maintenance manuals. Include the following:
 - 1. Manufacturer's instructions on maintenance renewal of applied treatments.
 - 2. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum 10 years documented experience.
- B. Installer Qualifications: An installer (applicator) who is approved, trained, or certified by fluid-applied floor sealer manufacturer.
- C. Source Limitations: Furnish products from one manufacturer for entire Project, unless otherwise acceptable to Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manner to prevent damage to containers and bags.
- B. Store materials in accordance with manufacturer's instructions in clean and dry location with temperature between 60 deg F and 90 deg F.
- C. Keep products away from fire or open flame.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting flooring application.
 - 1. Do not apply flooring until spaces are enclosed and weatherproof; wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete.
- B. Conditioning Period: Begins not less than 7 days before flooring application, is continuous through application, and continues not less than 3 days after application.
 - 1. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Ventilate area where flooring is being installed. Post and enforce no smoking and no open flame signs until flooring has cured.
- D. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during floor sealer application.
- E. Close spaces to traffic during floor sealer application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.7 WARRANTY

- A. Provide written warranty signed by manufacturer warranting work to be free from defective materials and workmanship and agreeing to replace components which fail within 2 years from date of Substantial Completion.
 - 1. Failed materials and workmanship includes spalling, cracking, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dayton Superior Specialty Chemical Corp.
 - 2. L & M Construction Chemicals, Inc.
 - 3. Euclid Chemical.
 - 4. The Sherwin-Williams Company.

2.2 CONCRETE FLOOR SEALER

- A. Epoxy Floor Coating: Two component, water-based, high-performance, high-solids, epoxy floor coating system.
 - 1. Basis-of-Design Products:
 - a. The Sherwin-Williams Company; Armorseal 8100 Water Based Epoxy Floor Coating, clear.
 - b. Euclid; Euco 512 VOX Epoxy Sealer.
 - 2. Use sealers that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 ACCESSORIES

- A. Joint Sealant Materials: Manufacturer's recommended sealant compatible with flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of flooring including substrate moisture content.
- B. Examine areas to receive flooring for:
 - 1. Defects in substrate that may affect proper execution of flooring work.
 - 2. Deviations beyond allowable tolerance for concrete slab work.
 - 3. Surface curing agents or sealers that would inhibit bond.
 - 4. Surface defects such as cracks that could transfer through to finished flooring surface if not corrected.
- C. Do not begin flooring work until concrete has cured a minimum of 28 days.
- D. Do not begin work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare Substrate: Tests concrete substrate for pH, contaminants, and moisture content in accordance with manufacturer's recommendations. Ensure concrete is within manufacturers recommended limits prior to installation.
- B. Concrete Sub-floors: Verify that concrete slabs comply with ASTM D 4258 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
 - 2. Mechanically abrade or shot-blast concrete flooring to remove inappropriate curing agents and to open pores of concrete surfaces to allow penetration of bonding agent. Completely remove cleaning residue. Acid washing is not acceptable.
 - 3. Repair cracks, divots and surface imperfections according to manufacturer's instructions.
 - 4. Vacuum to remove dust and debris.
- C. Protect walls, floor openings, equipment, electrical openings, door frames, and other obstructions during installation. Cover floor and wall areas at mixing stations.

3.3 APPLICATION

- A. General: Mix and apply flooring components according to manufacturer's written instructions.
- B. Apply a minimum of 2 coats in accordance with manufacturer's recommended coverage rates.

3.4 CURING

- A. Cure flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process.

3.5 CLEANING AND PROTECTION

- A. Clean as recommended by manufacturer. Do not use materials or methods which may damage surface or surrounding construction.
- B. Remove temporary covering and clean flooring prior to final inspection. Use cleaning materials and procedures recommended by flooring manufacturer.
- C. Do not permit traffic over finished flooring surfaces.
- D. Protect flooring materials from damage and wear during construction operation.

END OF SECTION

SECTION 096513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- 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. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 2. Flexco.
 - 3. Johnsonite; a Tarkett company.

- 4. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings.
 - C. Thickness: 0.125 inch (3.2 mm).
 - D. Height: As indicated on Drawings.
 - E. Lengths: Coils in manufacturer's standard length.
 - F. Outside Corners: Job formed or preformed.
 - G. Inside Corners: Job formed or preformed.
 - H. Colors: As scheduled.
- 2.2 RUBBER MOLDING ACCESSORY
 - 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. Roppe Corporation, USA.
 - 2. VPI Corporation.
 - B. Profile and Dimensions: As indicated.
 - C. Locations: Provide rubber molding accessories in areas indicated.
 - D. Colors and Patterns: As Scheduled.
- 2.3 INSTALLATION MATERIALS
 - A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
 - B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.
- 3.2 PREPARATION
 - A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
 - B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
 - C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- 3.3 RESILIENT BASE INSTALLATION
 - A. Comply with manufacturer's written instructions for installing resilient base.
 - B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
 - D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - E. Do not stretch resilient base during installation.
 - F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
 - G. Preformed Corners: Install preformed corners before installing straight pieces.
 - H. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Miter corners to minimize open joints.
- 3.4 RESILIENT ACCESSORY INSTALLATION
- A. Comply with manufacturer's written instructions for installing resilient accessories.
 - B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.
- 3.5 CLEANING AND PROTECTION
- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
 - B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 - D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 096519

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations directed by Architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SOLID VINYL FLOOR TILE

- 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. Armstrong World Industries, Inc.
 - 2. Gerflor.
 - 3. Johnsonite; a Tarkett company.
 - 4. Mannington Mills, Inc.
 - 5. Shaw Contract Group; a Berkshire Hathaway company.
- B. Tile Standard: ASTM F 1700.
 - 1. Class and Type: As scheduled.
- C. Thickness: As scheduled.
- D. Size: As scheduled.
- E. Colors and Patterns: As scheduled.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 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. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75percent relative humidity level measurement.
 - c. Water Absorption Test: Perform test according to ASTM F 3191.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular carpet tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of edge, transition, and other accessory strips.
 - 9. Transition details to other flooring materials.
- C. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups at locations and in sizes shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.7 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. As scheduled.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 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. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
 - d. Water Absorption Test: Perform test according to ASTM F 3191.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl wall covering.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- C. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- (914-mm-) long in size.
 - 1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied. Show complete pattern repeat.
- D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

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

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. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.
 - 1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141 for appearance shading characteristics.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
- B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265.

2.2 VINYL WALL COVERING

- A. As scheduled.

2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for level 4 finish, surface flatness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 2. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
 1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip or as recommended by wall covering manufacturer.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Match pattern as recommended by wall covering manufacturer above the finish floor.
- F. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 098116

ACOUSTICAL BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Owens Corning.
 - 2. Slag-Wool-/Rock-Wool-Fiber Insulation:
 - a. Fibrex Insulations Inc.
 - b. Owens Corning.
 - c. Thermafiber.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Unfaced Mineral-Fiber Blanket Insulation (in walls): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Unfaced, Flexible Glass-Fiber Blanket Insulation (above ceilings): ASTM C 612, Type IA; ASTM C 553, Types I, II, and III; or ASTM C 665, Type I; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
 - 1. Nominal density of 1.0 lb/cu. ft., thermal resistivity of 3.7 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 2. Nominal density of not less than 1.5 lb/cu. ft. nor more than 1.7 lb/cu. ft., thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 3. Combustion Characteristics: Passes ASTM E 136.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.5 PROTECTION

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

END OF SECTION

SECTION 099123

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. 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.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 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.

1.4 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. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. 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.
- B. Colors: As scheduled.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
 - 2. 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. 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. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- F. Rated Wall Assemblies Identification:
 - 1. Identify fire-rated wall assemblies with stenciled lettering on wall surface above ceiling line.
 - 2. Provide stenciled block letters in red to identify each rated wall assembly.
 - 3. Refer to Section 092900 "Gypsum Board" and Life Safety Legend on Code Compliance Plan.

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. Gypsum Board, Semigloss, Latex-Based Acrylic-Enamel Finish: 2 finish coats over a primer.
 - 1. Behr:
 - a. Primer: Behr Premium Plus Interior Drywall Primer & Sealer 73, .09 mils DFT
 - b. Second Coat: Behr Pro i300 Interior Semi-Gloss 370, 1.45 mils DFT.
 - c. Third Coat: Same as second coat.
 - 2. PPG:
 - a. Primer: 6-2 Speedhide Interior Latex Sealer
 - b. Second Coat: Speedhide Zero Interior Latex semi-Gloss 6-4510XI, 1.3 mils DFT.
 - c. Third Coat: Same as second coat.
 - 3. Sherwin-Williams:
 - a. Primer: Roller applied latex texturing compound, ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. Second Coat: ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series 1.6 mils DFT.
 - c. Third Coat: Same as second coat.
- B. Gypsum Board, Eggshell, Low Odor: 2 finish coats over a primer.
 - 1. Behr:
 - a. Primer: Behr Premium Plus Interior Drywall Primer & Sealer 73, .09 mils DFT
 - b. Second Coat: Behr Pro i300 Interior Eggshell 330, 1.45 mils DFT.
 - c. Third Coat: Same as second coat.
 - 2. PPG:
 - a. Primer: 6-2 Speedhide Interior Latex Sealer, 1.2 mils DFT.
 - b. Second Coat: Speedhide Zero Interior Latex Eggshell 6-4310XI, 1.5 mils DFT.
 - c. Third Coat: Same as second coat.
 - 3. Sherwin-Williams:
 - a. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - b. Second Coat: PorMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series 1.7 mils DFT.
 - c. Third Coat: Same as second coat.

- C. Clear Woodwork, Alkyd-Based, Satin-Varnish Finish: 2 finish coats of an alkyd-based, clear-satin varnish over a sealer coat and an alkyd-based, interior wood stain. Wipe wood filler before applying stain.
1. Behr:
 - a. First Coat: Minwax Fast Dry Polyurethane Clear Satin 63010
 - b. Second Coat: Same as first coat.
 2. PPG:
 - a. First Coat: DFT157 Deft Interior Acrylic Polyurethane Gloss
 - b. Second Coat: Same as first coat.
 3. Sherwin-Williams:
 - a. First Coat: Wood Classics Fast Dry Oil Varnish, A66-300 Series, 1.3 mils DFT.
 - b. Top Coat: Same as first coat.
- D. Ferrous Metal, Eggshell, Acrylic-Enamel Finish: Two finish coats over a primer.
1. Behr:
 - a. Primer: Behr Premium Plus Multi-Surface Primer & Sealer 436, 1.7 mils DFT
 - b. Second Coat: Behr Direct To Metal Semi-Gloss Enamel 3200, 1.75 mils DFT
 - c. Third Coat: Same as second coat.
 2. PPG:
 - a. Primer: 4020 Pitt Tech Plus Acrylic Primer/finish DTM, 3.0 mils DFT.
 - b. Second Coat: 90-1110 Pitt-Tech Plus Int./Ext. Satin DTM Industrial Enamel. 2.0 mils DTM.
 - c. Third Coat: Same as second coat.
 3. Sherwin-Williams:
 - a. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series 2.0 - 4.0 mils DFT.
 - b. Second Coat: Pro Industrial Acrylic Eg-Shel, B66-660 Series 2.5 mils DFT.
 - c. Third Coat: Same as second coat.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identifying devices where shown on the Drawings complete and as specified including the following:
 - a. Parking signs indicating accessible spaces.
 - b. Interior code required signs.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- B. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, accessories, layout, and installation details.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.
- B. Manufacturer shall have a minimum of five years experience in the manufacturing of signs specified.
- C. Codes and Standards:
 - 1. Panel signs shall have 1/32-inch raised copy and grade 2 Braille, and shall comply with all existing federal, state, and local accessibility standards.
 - 2. Code and Standards: Comply with American with Disabilities Act of 1990, Title 3 Provisions, Public Accommodations and Commercial Facilities. Updated March 15, 2012.
 - 3. Comply with the State of Texas Accessibility Standards, 2012 edition, as administered by the Texas Department of Licensing and Regulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Best Sign Systems, Montrose, Colorado.
 - 2. Mohawk Sign Systems, Schenectady, New York.
 - 3. Nelson-Harkins, Chicago, Illinois.
 - 4. ASI Signs, Dallas, Texas.

2.2 ACCESSIBLE PARKING

- A. Screen Printed Signs:
 - 1. 18 gage bonderized steel with blue baked enamel finish and white screen printed copy.
 - 2. Copy and Size:
 - a. "Accessible Parking Only" – 12 inches by 18 inches.
 - b. "Van Accessible" – 12 inches by 6 inches.
 - 3. Acceptable Product: Best Traffic Signs No. SS04 with SS52 as required.
- B. Post: Galvanized pipe column minimum 9 feet long.

2.3 ROOM SIGNAGE SYSTEMS

- A. Basis-of-Design Product: ASI Unframed SP Series Signs with requirements indicated for materials, thickness, finish colors, designs, shapes, sizes and details.
- B. Sign Face: Clear acrylic, 0.080-inch thick, matte first surface.
 - 1. Adhesive: Pressure sensitive adhesive film, second surface.
- C. Tactile Graphics and Text:

1. Fabrication: Provide tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer's stratification process as follows:
 - a. Basis-of-Design Product: ASI Intouch, photo-mechanical method.
 2. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.
- D. Non-Tactile Graphics and Text:
1. Fabrication options:
 - a. Basis-of-Design Product: ASI; Series SPE/SPJ: Non-tactile graphic plaque, no back plate.
 2. Text or graphic technique:
 - a. Screen process using subsurface method.
 3. Provide lettering and graphics precisely formed, uniformly opaque, and consistent in size, style, spacing, content, position, and colors.
- E. Overall Panel Size: Refer to Drawings.
- F. Panel Colors: As selected by Architect.
- G. Text or Graphic Colors: As selected by Architect.
- H. Letter styles, colors, letter sizes and layout position: As selected by Architect.
- I. Installation Method: System SA, silicone adhesive.

PART 3 - EXECUTION

3.1 DELIVERY AND STORAGE

- A. Deliver and store identifying devices in protective wrappings until ready for installation. Install letters in protective wrappings and remove wrappings just prior to substantial completion.

3.2 INSTALLATION

- A. Install signs plumb, level and square and in proper planes with other work, at heights required by accessibility codes and standards.
- B. Anchor each plastic laminate sign with adhesive.
- C. Install signs with sufficient amount of foam tape for proper installation.
- D. Attach as recommended by sign manufacturer.
- E. Anchor each sign with adhesive.
- F. Coordinate arrival and installation of graphic signs with hardware installation. Graphic signs function as and are coordinated with the hardware as shown on the Drawings.
- G. Room name signs shall be placed on the public side of the door except where noted otherwise.
- H. Single Door Sign: Provide one sign as specified above, mounted to wall adjacent to door on knob side.
- I. Pair of Doors: Provide one sign as specified above, mounted to adjacent wall closest to active leaf of door. Do not install sign where it will be obstructed by door when door is in the 'open' position.
- J. Attachment: Mounting to surfaces shall be done by pressure sensitive frame double-faced tape. Signs shall be delivered to the project site with the tape in place and trimmed on each sign, but with the protective paper layer not removed. Paper layer shall be removed just prior to installation of signs.

3.3 EXTERIOR INSTALLATION - PARKING SIGNS

- A. Mount posts in 12-inch round by 2'-6" deep concrete footing.
- B. Accessible Signs: Mount signs at height to comply with accessibility codes.

3.4 COORDINATION

- A. Coordinate the installation of the identifying devices with the hardware manufacturer for lockset and knob leave outs as detailed and scheduled.

3.5 DAMAGE

- A. Any identifying device which is scratched or defaced will be rejected.

3.6 CLEANING

- A. Remove protective materials and clean all signs. Clean surfaces with plain water or water with soap or household detergent.

END OF SECTION

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
 - 2. Abuse-resistant wall coverings.

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.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner Guards: 12 inches (300 mm) long. Include example top caps.
 - 2. Abuse-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.

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, 48-inch- (1200-mm-) long 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- covers in a horizontal position.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

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.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 CORNER GUARDS

- 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- or 135-degree turn to match wall condition.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Balco, Inc.
 - b. Construction Specialties, Inc.
 - c. InPro Corporation (IPC).
 - d. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - e. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - 2. Basis-of-Design Product: As scheduled.
 - 3. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Height: As indicated on Drawings.
 - b. Color and Texture: As scheduled.
 - 4. Continuous Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum-.
 - 5. Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - 6. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 ABUSE-RESISTANT WALL COVERINGS

- A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arden Architectural Specialties, Inc.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. InPro Corporation (IPC).
 - e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - f. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - g. Pawling Corporation.
 - 2. Basis-of-Design Product: As scheduled.
 - 3. Size: 48 by 120 inches (1219 by 3048 mm) for roll.
 - 4. Sheet Thickness: 0.060 inch (1.5 mm).
 - 5. Color and Texture: As scheduled.
 - 6. Height: As indicated.
 - 7. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
 - 8. Mounting: Adhesive.

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. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

- C. 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.
- D. Adhesive: As recommended by protection product manufacturer.

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.
- D. Wood Handrails: Miter corners and ends of wood handrails for returns.

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 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.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing 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.
- 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. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm) apart.
 - 3. Adjust end caps as required to ensure tight seams.
- D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.

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 PUBLIC-USE WASHROOM ACCESSORIES

- A. Accessories: As Scheduled on Drawings.

2.2 PRIVATE-USE BATHROOM ACCESSORIES

- A. Accessories: As Scheduled on Drawings.

2.3 UNDERLAVATORY GUARDS

- A. Underlavatory Guard:
 - 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. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
3. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
4. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Mop and Broom Holder:
 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. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Brey-Krause Manufacturing Co.
 - f. GAMCO Specialty Accessories; a division of Bobrick.
 - g. Tubular Specialties Manufacturing, Inc.
 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 3. Length: 36 inches (914 mm).
 4. Hooks: Four.
 5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
 - b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.5 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. 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.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

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

SECTION 104413

FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. 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.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.
- B. 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. Babcock-Davis.
 - 2. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 3. Larsens Manufacturing Company.
 - 4. Nystrom, Inc.
 - 5. Potter Roemer LLC.
 - 6. Strike First Corporation of America (The).

2.2 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.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
- B. Cabinet Construction: Nonrated and rated to match adjacent 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 Material: Cold-rolled steel sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.

- F. Door Material: Steel sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: 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. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 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. Miter corners and grind smooth.
 - 3. Provide factory-drilled mounting holes.
 - 4. 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 and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification:
 - 1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104416
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

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 and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis.
 - b. Amerex Corporation.
 - c. Brooks Equipment Co., Inc.
 - d. Buckeye Fire Equipment Co.
 - e. Fire-End & Croker Corporation.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 3. Valves: Manufacturer's standard.
 - 4. Handles and Levers: Manufacturer's standard.
 - 5. 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.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at height to meet requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 105113

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Knocked-down corridor lockers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
 - a. Blank identification plates.
 - b. Hooks.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate sizes and locations of wood bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards (TAS).

2.3 KNOCKED-DOWN LOCKERS

- A. Products: Subject to compliance with requirements, provide one of the following:
1. ASI Storage Solutions; ASI Group; Traditional Plus.
 2. List Industries Inc.; Standard Quiet KD.
 3. Lyon Workspace Products, LLC; Heavy Duty Corridor Lockers.
 4. Penco Products, Inc; Guardian.
 5. Republic Storage Systems, LLC; Quiet Locker.
- B. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
 2. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
 3. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 4. Door Style: Vented panel as follows:
 - a. Louvered Vents: Concealed vents in door edges.
- C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
 2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
 3. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.
- F. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
 - a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

- G. Locks: Prepared for locks by others.
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.
- I. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.
- J. Coat Rods: Manufacturer's standard.
- K. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm) nominal-thickness steel sheet.
 - 1. Height: 4 inches (102 mm).
- L. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
 - 1. Closures: Vertical-end type.
 - 2. Sloping-top corner fillers, mitered.
- M. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- N. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
- O. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
- P. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- Q. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.
 - a. Locker Interior: Color to match exterior locker color.

2.4 LOCKS

- A. Built-in Combination Lock: Key-controlled, three-number dialing combination locks; capable of at least five combination changes made automatically with a control key.
 - 1. Bolt Operation: Manually locking deadbolt.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - 2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
 - 3. Coat Rods: As indicated on Drawings.
- D. Knocked-Down Construction: Fabricate metal lockers by assembling at Project site, using manufacturer's nuts, bolts, screws, or rivets.
- E. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloping-top corner fillers, mitered.
- H. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.

- I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- J. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
 - 4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

SECTION 113013

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Residential appliances.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains a service center capable of providing training, parts, and emergency maintenance repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.
- C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

2.3 RESIDENTIAL APPLIANCES

- A. As scheduled.

2.4 GENERAL FINISH REQUIREMENTS

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

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

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

END OF SECTION

SECTION 122413

ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.
 - 2. Motor-operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark interior face of material if applicable.
 - 2. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.
- C. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- 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. CACO, Inc., Window Fashions.
 - 2. Draper Inc.
 - 3. Hunter Douglas Contract.
 - 4. Insolroll Window Shading Systems.
 - 5. Lutron Electronics Co., Inc.
 - 6. MechoShade Systems, Inc.
 - 7. Qmotion Shades.
 - 8. Silent Gliss.
 - 9. Springs Window Fashions; SWFcontract.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: As indicated on Drawings.
 - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
 - 1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
 - 2. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: As indicated on Drawings.

3. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
4. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

- 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. CACO, Inc., Window Fashions.
 2. Draper Inc.
 3. Hunter Douglas Contract.
 4. Insolroll Window Shading Systems.
 5. Lutron Electronics Co., Inc.
 6. MechoShade Systems, Inc.
 7. Qmotion Shades.
 8. Silent Gliss.
 9. Springs Window Fashions; SWFcontract.
- B. Motorized Operating Systems: Provide factory-assembled, shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in rollers.
 - a. Electrical Characteristics: As recommended by manufacturer.
 - b. Maximum Total Shade Width: As required to operate roller shades indicated.
 - c. Maximum Shade Drop: As required to operate roller shades indicated.
 - d. Maximum Weight Capacity: As required to operate roller shades indicated.
 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting. Provide the following for remote-control activation of shades:
 - a. Individual/Group Control Station: Maintained -contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
 - b. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
 - c. Color: As selected by Architect from manufacturer's full range.
 4. Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.
 5. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
 - b. Capable of interface with audiovisual control system.
 - c. Capable of accepting input from building automation control system.
 - d. Override switch.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.
 1. Double-Roller Mounting Configuration: Side by side.
 2. Inside Roller:
 - a. Drive-End Location: As indicated on Drawings.
 - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 3. Outside Roller:
 - a. Drive-End Location: As indicated on Drawings.
 - b. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.

- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- E. Inside Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- F. Outside Shadebands:
 - 1. Shadeband Material: Light-blocking fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
 - 1. Endcap Covers: To cover exposed endcaps.
 - 2. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than height indicated on Drawings.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
 - 3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recesses or pockets and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: As indicated on Drawings.
 - 4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 - 5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 - 6. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: PVC-coated fiberglass.
 - 3. Roll Width: 36 inches (914 mm).
 - 4. Color: As selected by Architect from manufacturer's full range.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Fiberglass textile with PVC film bonded to both sides.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.5 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.
- C. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION

SECTION 123661.16

SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

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.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches (150 mm) square.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 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. Affinity Surfaces; a brand of Domain Industries, Inc.
 - b. Avonite Surfaces.
 - c. E. I. du Pont de Nemours and Company.
 - d. Formica Corporation.
 - e. LG Chemical, Ltd.
 - f. Meganite Inc.
 - g. Samsung Chemical USA, Inc.
 - h. Staron; Lotte Chemical Co., LTD.

- i. Swan Corporation (The).
 - j. Wilsonart.
 - 2. Basis-of-Design Product: As scheduled.
 - 3. Type: Provide Standard type unless Special Purpose type is indicated.
 - 4. Colors and Patterns: As scheduled.
 - B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
 - C. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Doug Mockett & Company, Inc.: TG Flip-Top Series.
 - 2. Outside Diameter: 2 inches (51-mm).
 - 3. Color: As selected by Architect from Manufacturer's full range.
 - D. Countertop Support Brackets: Steel, 18 inches by 24 inches, minimum 1,000 lb load limit, factory-applied primer for field painting in accordance with Section 099123 "Interior Painting."
 - 1. Acceptable Products:
 - a. A & M Hardware; Work Station Brackets.
 - 1) Provide manufacturer's standard factory-applied primer. Refer to Section 099123 "Interior Painting" for finish coat.
- 2.2 COUNTERTOP FABRICATION
- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.
 - B. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material.
 - C. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material with wood-trimmed edges.
 - D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
 - E. Joints: Fabricate countertops without joints.
 - F. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
- 2.3 INSTALLATION MATERIALS
- A. Adhesive: Product recommended by solid surface material manufacturer.
 - B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill 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.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. 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.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
 - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

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SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. General requirements for coordinating and scheduling commissioning activities.
 - 2. Commissioning meetings.
 - 3. Commissioning reports.
 - 4. Use of commissioning process test equipment, instrumentation, and tools.
 - 5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
 - 6. Commissioning tests and commissioning test demonstration.
 - 7. Adjusting, verifying, and documenting identified systems and assemblies.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Commissioning Authority responsibilities.
 - 2. Section 011200 "Multiple Contract Summary" for Commissioning Authority responsibilities.
 - 3. Section 013300 "Submittal Procedures" for submittal procedure requirements for commissioning process.
 - 4. Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
 - 5. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.
 - 6. Section 019119.43 "Exterior Enclosure Commissioning" for technical commissioning requirements for exterior closure.
 - 7. Section 210800 "Commissioning of Fire Suppression" for technical commissioning requirements for fire suppression.
 - 8. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
 - 9. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
 - 10. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
 - 11. Section 270800 "Commissioning of Communications" for technical commissioning requirements for communications systems.
 - 12. Section 280800 "Commissioning of Electronic Safety and Security" for technical commissioning requirements for electronic safety and security systems.

1.2 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- B. Basis-of-Design Document: A document prepared by Architect that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.
- D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.
- E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of the commissioning process is defined in [Section 011000 "Summary."] [Section 011200 "Multiple Contract Summary."]
- F. Construction-Phase Commissioning-Process Completion: The stage of completion and acceptance of

commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date construction-phase commissioning-process completion is achieved. See Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.

1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following:
 - a. Completion of tests and acceptance of test results.
 - b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
 - c. Comply with requirements in Section 017900 "Demonstration and Training."
 - d. Completion and acceptance of submittals and reports.
- G. Owner's Project Requirements: A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This document is prepared either by the Owner or for the Owner by the Architect or Commissioning Authority.
- H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.3 INFORMATIONAL SUBMITTALS

- A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedure general requirements for commissioning process.
- B. Commissioning Plan Information:
 1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors performing the various commissioning requirements.
 2. Schedule of commissioning activities, integrated with the Construction Schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for the Construction Schedule general requirements for commissioning process.
 3. Contractor personnel and subcontractors participating in each test.
 4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.
- C. Commissioning schedule.
- D. Two-week look-ahead schedules.
- E. List test instrumentation, equipment, and monitoring devices. Include the following information:
 1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
 2. Brief description of intended use.
 3. Calibration record showing the following:
 - a. Calibration agency, including name and contact information.
 - b. Last date of calibration.
 - c. Range of values for which calibration is valid.
 - d. Certification of accuracy.
 - e. Certification for calibration equipment traceable to NIST.
 - f. Due date of the next calibration.
- F. Test Reports:
 1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.
 2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
 3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit

- commissioning issue reports for tests for which acceptable results were not achieved.
- 4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
- 5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
- 6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

- G. Construction Checklists:
 - 1. Material checks.
 - 2. Installation checks.
 - 3. Startup procedures, where required.

1.4 CLOSEOUT SUBMITTALS

- A. Commissioning Report:
 - 1. At Construction-Phase Commissioning Completion, include the following:
 - a. Pre-startup reports.
 - b. Approved test procedures
 - c. Test data forms, completed and signed.
 - d. Progress reports.
 - e. Commissioning issue report log.
 - f. Commissioning issue reports showing resolution of issues.
 - g. Correspondence or other documents related to resolution of issues.
 - h. Other reports required by commissioning process.
 - i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction-Phase Commissioning Completion.
 - j. Report shall include commissioning work of Contractor.
- B. Request for Certificate of Construction-Phase Commissioning Process Completion.
- C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.
- B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:
 - 1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
 - 2. Calibrated and certified.
 - a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags shall be permanently affixed.
 - b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
 - 3. Maintain test equipment and instrumentation.
 - 4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.
 - 1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.

2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

- A. General Format and Organization:
 1. Bind report in three-ring binders.
 2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
 3. Record report on compact disk.
 4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.
- B. Commissioning Report:
 1. Include a table of contents and an index to each test.
 2. Include major tabs for each Specification Section.
 3. Include minor tabs for each test.
 4. Within each minor tab, include the following:
 - a. Test specification.
 - b. Pre-startup reports.
 - c. Approved test procedures.
 - d. Test data forms, completed and signed.
 - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

- A. Construction checklists cannot modify or conflict with the Contract Documents.
- B. Create construction checklists based on actual systems and equipment to be included in Project.
- C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.
 1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
 2. Included optional features.
 3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
 4. Installation Checks:
 - a. Location according to Drawings and approved Shop Drawings.
 - b. Configuration.
 - c. Compliance with manufacturers' written installation instructions.
 - d. Attachment to structure.
 - e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
 - f. Utility connections are of the correct characteristics, as applicable.
 - g. Correct labeling and identification.
 - h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

- D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.
- E. Performance Tests:
 - 1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
 - 2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
 - 3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
 - 4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
 - 5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.
- F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, deferred construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
 - 1. Identify deferred construction checklists by number and title.
 - 2. Provide a target schedule for completion of deferred construction checklists.
 - 3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.
- G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, delayed construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
 - 1. Identify delayed construction checklist by construction checklist number and title.
 - 2. Provide a target schedule for completion of delayed construction checklists.
 - 3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

- A. Schedule and coordinate commissioning process with the Construction Schedule.
- B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.
- C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.
 - 1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
 - a. General Inspection: [Level I] [Level II] [Level III] <Insert level>.
 - b. Special Inspection: **[Level S-1] [Level S-2] [Level S-3] [Level S-4]** <Insert level>.
 - c. Acceptance Quality Limit (AQL) of **[1.5]** <Insert AQL>.
 - 2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
 - 3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
 - 4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.
- D. Report test data and commissioning issue resolutions.
- E. Schedule personnel to participate in and perform Commissioning-Process Work.
- F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:
 - 1. Operating the equipment and systems they install during tests.
 - 2. In addition, installing contractors may be required to assist in tests of equipment and systems with

which their work interfaces.

3.4 CONTRACTOR'S RESPONSIBILITIES

- A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:
1. Coordinate with subcontractors on their commissioning responsibilities and activities.
 2. Obtain, assemble, and submit commissioning documentation.
 3. **[Attend] [Conduct]** periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
 4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
 5. Review and comment on preliminary test procedures and data forms.
 6. Report inconsistencies and issues in system operations.
 7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
 8. Direct and coordinate test demonstrations.
 9. Coordinate witnessing of test demonstrations by Owner's witness.
 10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
 11. Prepare and submit specified commissioning reports.
 12. Track commissioning issues until resolution and retesting is successfully completed.
 13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
 14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

- A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.
- B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published Commissioning Schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning process.
- C. Construction Checklists:
1. Complete construction checklists as Work is completed.
 2. Distribute construction checklists to installing contractors before they start work.
 3. Installers:
 - a. Verify installation using approved construction checklists as Work proceeds.
 - b. Complete and sign construction checklists **[daily] [weekly] <Insert frequency>** for work performed during the preceding **[day] [week] <Insert time period>**.
 4. Provide Commissioning Authority access to construction checklists.
- D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.
- E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.
- F. Test Procedures and Test Data Forms:
1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
 2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
 3. Completed test data forms are the official records of the test results.

4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
 5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:
 - a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
 - b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.
 6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
 7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.
- G. Performance of Tests:
1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
 2. Perform and complete each step of the approved test procedures in the order listed.
 3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
 4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
 5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.
- H. Performance of Test Demonstration:
1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be [100] <Insert number> percent unless otherwise indicated in the individual test specification.
 2. Notify Owner's witness at least **[three days]** <Insert alternative time> in advance of each test demonstration.
 3. Perform and complete each step of the approved test procedures in the order listed.
 4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
 5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
 6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
 - a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.
 7. False load test requirements are specified in related sections.
 - a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.
- I. Deferred Tests:
1. Deferred Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction-Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction-Phase Commissioning Process Completion as follows:

- a. Identify deferred tests by number and title.
 - b. Provide a target schedule for completion of deferred tests.
 2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least [three working days] <Insert alternative time> (minimum) in advance of tests.
 3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.
- J. Delayed Tests:
 1. Delayed Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. Include the following in the request for Certificate of Construction-Phase Commissioning Process Completion:
 - a. Identify delayed tests by test number and title.
 - b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
 2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least [three working days] <Insert alternative time> (minimum) in advance of tests.
 3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.
- K. Commissioning Compliance Issues:
 1. Test results that are not within the range of acceptable results are commissioning compliance issues.
 2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
 3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
 4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
 - a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
 - b. Submit commissioning compliance issue report form within **[24 hours]** <Insert alternative time> of the test.
 - c. Determine the cause of the failure.
 - d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
 5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
 - a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
 - b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
 - c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
 - d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.
 6. Diagnose and correct failed test demonstrations as follows:
 - a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
 - b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
 - c. Record the results of each step of the diagnostic procedure.

- d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
 - e. Determine and record corrective measures.
 - f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.
7. Retest:
- a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
 - b. For each repeated test demonstration, submit a new test data form, marked "Retest."
8. Do not correct commissioning compliance issues during test demonstrations.
- a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than [five] <Insert number> minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 SEQUENCING

- A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:
- 1. Construction Checklists:
 - a. Material checks.
 - b. Installation checks.
 - c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
 - d. Performance Tests:
 - 1) Static tests, as appropriate.
 - 2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
 - 3) Equipment and assembly performance tests.
 - 4) System performance tests.
 - 5) Intersystem performance tests.
 - 2. Commissioning tests.
- B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.
- C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.
- D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.7 SCHEDULING

- A. Commence commissioning process as early in the construction period as possible.
- B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule. See Section 013200 "Construction Progress Documentation."
- 1. Include detailed commissioning activities in monthly updated Construction Schedule and short-interval schedule submittals.
 - 2. Schedule the start date and duration for the following commissioning activities:
 - a. Submittals.
 - b. Preliminary operation and maintenance manual submittals.
 - c. Installation checks.
 - d. Startup, where required.
 - e. Performance tests.
 - f. Performance test demonstrations.

- g. Commissioning tests.
 - h. Commissioning test demonstrations.
 - 3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
 - 4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.
- C. Two-Week Look-Ahead Commissioning Schedule:
 - 1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning process.
 - 2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
 - 3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.
- D. Owner's Witness Coordination:
 - 1. Coordinate Owner's witness participation via Architect.
 - 2. Notify Architect of commissioning schedule changes at least **[two]** **<Insert number>** work days in advance for activities requiring the participation of Owner's witness.

3.8 COMMISSIONING REPORTS

- A. Test Reports:
 - 1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:
 - a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
 - b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
 - c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
 - d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
 - e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.
 - 2. Test data reports include the following:
 - a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
 - b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
 - c. Signatures of individuals performing and witnessing tests.
 - d. Data trend logs accumulated overnight from the previous day of testing.
 - 3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
 - a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
 - b. Action distribution list.
 - c. Report date.

- d. Test number and description.
- e. Equipment identification and location.
- f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
- g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
- h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
- i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
- j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
- k. Schedule for retesting.
- 4. Weekly progress reports include information for tests conducted since the preceding report and the following:
 - a. Completed data forms.
 - b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
 - c. Activities scheduled but not conducted per schedule.
 - d. Commissioning compliance issue report log.
 - e. Schedule changes for remaining Commissioning-Process Work, if any.
- 5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
 - a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
 - b. Attach to the data form printed trend log data collected during the test or test demonstration.
 - c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.
- 6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
 - a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.9 CERTIFICATE OF CONSTRUCTION-PHASE COMMISSIONING PROCESS COMPLETION

- A. When Contractor considers that construction-phase commissioning process, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning process.
- B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction-phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction-Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction-Phase Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction-phase commissioning process completion.
- C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.
- D. When construction-phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction-Phase Commissioning Process Completion that shall

establish the date of completion of construction-phase commissioning process. Certificate of Construction-Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for combination sprinkler and standpipe systems.

1.2 SUBMITTALS

- A. All submittals are to be complete. Partial submittals will not be reviewed.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum five experience.
 - 2. Approved by manufacturer.
- C. Conform to UL and FM requirements.
- D. Valves: Bear FM and UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform to NFPA 13.

2.2 ABOVE GROUND PIPING

- A. All sprinkler piping and fittings are to be American made.
- B. 2 inch and smaller: Steel Pipe: ASTM A795 Schedule 40, black.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded.
- C. 2-1/2 inch and larger: Steel Pipe: ASTM A795 Schedule 10, or ASTM A135/A135M Schedule 10, black.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded.
 - 2. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE SLEEVES

- A. Horizontal and Vertical Piping:
 - 1. Sleeve Length: 4 inch above finished floor.
 - 2. Provide sealant for watertight joint.
- B. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 - 3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in

accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.4 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

2.5 ESCUTCHEONS

A. Material:

1. Chrome-plated.
2. Metals and Finish: Comply with ASME A112.18.

B. Construction:

1. One-piece for mounting on tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.6 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

2.7 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Inserts:
 1. Provide inserts for placement in concrete formwork.
- G. Pipe Hangers and Supports:
 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 2. Place hangers within 12 inches of each horizontal elbow.
 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Provide sleeves when penetrating footings, floors, walls, and partitions and seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- K. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a water-tight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- L. Escutcheons:
 - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.2 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. Flush all portions of the fire protection system with clean water to remove foreign debris prior to installation of sprinkler heads.
- D. Flush water main prior to fire pump three times at one week intervals to remove foreign debris.

END OF SECTION

SECTION 210553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.
- E. Ceiling Tacks.

1.2 SUBMITTALS

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Samples: Submit one nameplate material sample, one plastic tag, one metal tag, one plastic pipe marker, one plastic tape pipe marker and two ceiling tacks.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

- A. Instrumentation: Tags.
- B. Piping: Pipe markers.
- C. Relays: Tags.
- D. Valves: Nameplates and ceiling tacks where above lay-in ceilings.
- E. Zone control valves: Nameplates.

2.2 NAMEPLATES

- A. Manufacturers:
 - 1. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 - 2. Seton Identification Products: www.seton.com.
 - 3. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
- B. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/2 inch.
 - 3. Background Color: Black.
 - 4. Thickness: 1/8 inch.
 - 5. Plastic: Conform to ASTM D709.
 - 6. Attach with self-tapping, stainless steel screws or contact type permanent adhesive.
- C. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: Red.
 - 2. Letter Height: 1/4 inch.
 - 3. Overall Height: 3/4 inch.
 - 4. Background Color: White.
 - 5. Plastic: Conform to ASTM D709.
 - 6. Attach to ceiling grid with contact type permanent adhesive.

2.3 TAGS

- A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
 2. Brady Corporation: www.bradycorp.com.
 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 4. Seton Identification Products: www.seton.com.
- B. Metal Tags: Brass or stainless steel with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 STENCILS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 3. Seton Identification Products: www.seton.com.
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
 6. Equipment: 2-1/2 inch high letters.
- C. Stencil Paint: As specified in Section 099000, semi-gloss enamel, colors conforming to ASME A13.1.

2.5 PIPE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com.
 2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 3. Seton Identification Products: www.seton.com.
- B. Comply with ASME A13.1, 2007 Edition.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

2.6 CEILING TACKS

- A. Manufacturers:
1. Craftmark: www.craftmarkid.com.
- B. Description: Steel with 7/8 inch diameter color coded head.
- C. Color code as follows:
1. Fire Protection Control Valves: Orange.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use pipe markers on all piping:
1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to

each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

- F. Locate ceiling tacks to locate valves above T-bar type and hard ceilings. Locate in corner of panel closest to equipment.
- G. All above ceiling valve and equipment locations are to have ceiling tags.
- H. All major equipment to have a QR Code on it for JPS tracking purposes – code generated by JPS.

<u>Service</u>	<u>Color (Pipe/Background/Text)</u>	<u>Designation</u>
Fire Water	Red/Red/White	F
Sprinkler Water	Red/Red/White	AS

END OF SECTION

SECTION 210800

COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes Cx process requirements for the following fire-suppression systems, assemblies, and equipment:
 - 1. Water-based fire-suppression systems.
- B. Related Requirements:
 - 1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
 - 2. For construction checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

1.2 DEFINITIONS

- A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."
- B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."
- C. IgCC: International Green Construction Code.
- D. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

- A. Construction Checklists:
 - 1. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Contractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and NFPA 3 and to resolve any issues with the CxA.

1.4 QUALITY ASSURANCE

- A. Testing Equipment and Instrumentation Quality and Calibration:
 - 1. Capable of testing and measuring performance within the specified acceptance criteria.
 - 2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
 - 3. Be maintained in good repair and operating condition throughout duration of use on Project.
 - 4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Cx PROCESS

- A. Perform Cx process for fire-suppression system in accordance with the following:
 - 1. Section 019113 "General Commissioning Requirements."
 - 2. NFPA 3.

3.2 CONSTRUCTION CHECKLISTS

- A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each fire-suppression system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in NFPA 3. Contractor performs the following:
 - 1. Review fire-suppression system preliminary construction checklists and provide written comments

- on Construction Checklist items where appropriate.
 - 2. Return preliminary Construction Checklist with review comments within 10 days of receipt.
 - 3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
 - 4. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.
- B. Systems Required to Be Commissioned:
- 1. Fire-suppression sprinkler systems, including the following:
 - a. Wet-pipe sprinkler piping, fittings, sprinklers, and specialties.
 - b. Sleeves and sleeve seals.
 - c. Meters and gauges.
 - d. General-duty and specialty valves.
 - e. Hangers and supports.
 - f. Vibration isolation.
 - g. Identification.
 - h. Insulation.
 - 2. Documentation
 - a. Fire-suppression system operating manuals.
 - b. Documentation of required Cx.
 - c. Documentation of required operator training.
- 3.3 Cx TESTING PREPARATION
- A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.
 - B. Certify that fire-suppression system instrumentation and control systems have been completed and calibrated, that they are operating in accordance with the Contract Documents and approved submittals, and that pretest set points have been recorded.
 - C. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- 3.4 Cx TEST CONDITIONS
- A. Perform tests using design conditions, whenever possible.
 - 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
 - 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
 - 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
 - B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.
 - C. If seasonal testing is specified, complete appropriate initial performance tests and documentation, and schedule seasonal tests.
- 3.5 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS
- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
 - B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response compared to acceptance criteria.
 - C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
 - D. Comply with Construction Checklist requirements, including material verification, installation checks,

startup, and performance test requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.

- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
 - 1. Cx Construction Checklist verification tests.
 - 2. Cx Construction Checklist verification test demonstrations.

3.6 CONSTRUCTION CHECKLIST EXAMPLES

- A. Vibration Isolation in Fire-Suppression Systems:
 - 1. Components to Be Tested:
 - a. Vibration isolation control devices in water-based fire-suppression systems.
 - b. Support systems.
 - 2. Test Purpose: Evaluate effectiveness of vibration isolation control devices.
 - 3. Test Conditions: Measure vibration of the facility structure at three locations designated by Owner's witness while the isolated equipment operates.
 - a. Maximum speed.
 - b. Minimum speed.
 - c. Critical speed.
 - 4. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.
- B. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:
 - 1. Prerequisites: Acceptance of results of construction checklists for valves specified in the following Sections:
 - a. Section 210523 "General-Duty Valves for Water-Based Fire Protection Piping."
 - b. Section 211000 "Water-Based Fire-Suppression Systems."
 - c. Section 284621.11 "Addressable Fire-Alarm Systems."
 - d. Section 284621.13 "Conventional Fire-Alarm Systems."
 - e. Section 331415 "Site Water Distribution Piping."
 - 2. Equipment and Systems to Be Tested:
 - a. Supervised valves in water-based fire-suppression systems.
 - b. Division 28 fire-detection and -alarm systems.
 - 3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
 - 4. Test Conditions:
 - a. Fire-alarm system operating in normal, automatic mode.
 - b. Activate valve supervision devices and tamper switches, one at a time.
 - 5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.

END OF SECTION

SECTION 211300

FIRE SUPPRESSION SPRINKLER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

1.2 SUBMITTALS

- A. See Division 01 for submittal procedures.
- B. All submittals shall be complete. Partial submittals will not be reviewed.
- C. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls. Provide safety margin of 10psi or 10%, whichever is less.
 - 3. Submit shop drawings to Authority Having Jurisdiction for approval. Submit proof of approval to Architect.
- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.
- H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.3 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard onsite.
- B. Designer Qualifications: Design system under direct supervision of a Professional Fire Protection Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum five year's experience and approved by manufacturer.
- E. Equipment and Components: Provide products that bear FM label or marking.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 - PRODUCTS

2.1 SPRINKLER SYSTEM

- A. Sprinkler System: Provide full sprinkler coverage for renovated areas of the building.
- B. Water Supply: Determine volume and pressure from water flow test data.
- C. Interface system with building control system.

2.2 SPRINKLERS

- A. Ceiling Type: Semi-recessed institutional, tamper resistant anti-ligature pendent type, where indicated on plans.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: to match ceiling.
 - 4. Inner\outer link design
 - 5. Manufacturer\Model: Tyco RAVEN Studio Institutional Sprinklers
- B. Ceiling Type: Fully-recessed pendent type, where indicated on plans.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: to match ceiling.
 - 4. Inner\outer link design
 - 5. Manufacturer\Model: Tyco Fire RF-II
- C. Exposed Area Type: Pendant or Upright type with guard.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Manufacturer: Tyco Fire TY-FRB
- D. Guards: Finish to match sprinkler finish.

2.3 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 - 1. Activate electric alarm.
 - 2. Test and drain valve.
 - 3. Replaceable internal components without removing valve from installed position.
- B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.
- E. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- F. Flush entire piping system of foreign matter.
- G. Install guards on sprinklers where indicated or are in exposed mechanical rooms with low clearance.
- H. Hydrostatically test entire system.

END OF SECTION

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Galvanized-Steel Sheet: 22-guageminimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.2 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.3 HANGERS AND SUPPORTS

- A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.
- B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.4 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. Install escutcheons at all wall and floor penetrations.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- E. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Install sleeves for all pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
- D. Install escutcheons for piping with exposed penetrations of walls and ceilings.
- E. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.

- F. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.
- G. Install unions at final connection to each piece of equipment.

3.2 DIELECTRIC FITTINGS

- A. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.
- B. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.3 HANGERS AND SUPPORTS

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.
- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- G. Cut hanger rods to a maximum of 1 inch below fasteners.

END OF SECTION

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Sheet Sleeves: 22-gauge minimum thickness; round tube closed with welded longitudinal joint.

2.2 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 all piping passing through penetrations in floors, partitions, roofs, and walls. Install sleeves prior to installing pipe and insulation.
- 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. 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 4 inches above finished floor level.
 - 2. 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.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
- B. Related Sections include the following:
 - 1. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.2 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. SWP: Steam working pressure.
 - 6. TFE: Tetrafluoroethylene plastic.

1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. 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.
- C. 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 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.

- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- E. Valve Actuators:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Lever Handle: For quarter-turn valves NPS 6 and smaller.
- F. Extended Valve Stems: On insulated valves.
- G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- H. Threaded: With threads according to ASME B1.20.1.
- I. Valve Bypass and Drain Connections: MSS SP-45.

2.2 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. Two-Piece and Three Piece, Copper-Alloy Ball Valves:
 - a. Apollo Valve
 - b. Crane Co.
 - c. Hammond Valve.
 - d. Jamesbury, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
- D. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. 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.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. 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.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Mains:
 - a. Under 3" and under – Ball Valves
 - 2. Branches:
 - a. Under 3" and under – Ball Valves
 - 3. Throttling Service: Ball valves.

- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 3 and Smaller: Two or Three-piece, 600-psig CWP rating, copper alloy.
- D. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
- E. Cut threaded rods used for supports a maximum of 1 inch after fastener.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Valves can be installed in vertical piping if needed.
- E. Install valves in position to allow full stem movement.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.

3.5 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.

END OF SECTION

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 22 Section "Common Work Results for Plumbing"

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 SUBMITTALS

- A. Product Data: For each Type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Provide shop drawings for each location required for multiple piping supports and trapeze hangers. Provide manufacturer's catalog data including load capacity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Grinnell Corp.
 - d. National Pipe Hanger Corp.
 - e. PHD Manufacturing, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. National Pipe Hanger Corp.
 - d. Unistrut Corp.
 - 3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard painted or galvanized finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet

metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches beyond sheet metal shield.

2.3 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 5. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 6. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
 7. 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.
 8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 9. 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.
 10. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 11. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 12. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 13. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 14. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Cut hanger rods to a maximum of 1 inch below fasteners. Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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-joist 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. C-Clamps (MSS Type 23): For structural shapes.
 7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 8. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 9. 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.
 10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): See schedule below for length requirements.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
- ### 3.2 HANGER AND SUPPORT INSTALLATION
- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- H. Insulated Piping: Comply with the following:
 - 1. Install MSS SP-58, Type 39 protection saddles. 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.
 - 2. Shield Dimensions for Pipe: Not less than the following:
 - 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.
 - 3. Pipes NPS 8 and Larger: Include wood inserts.
 - 4. Insert Material: Length at least as long as protective shield.
 - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 PAINTING

- A. Touching Up: 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe labels.
 - 2. Valve tags.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 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 cover full 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, 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.

2.2 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 minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or beaded chain.
- 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 GENERAL

- A. All exposed piping is to be painted.

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 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.
- B. Locate ceiling tacks to locate valves above T-bar type and hard ceilings. Locate in corner of panel closest to equipment.
- C. All above ceiling valve and equipment locations are to have ceiling tags.
- D. All major equipment to have a QR Code on it for JPS tracking purposes – code generated by JPS
- E. Pipe Label Color Schedule:
1. Domestic Water Piping:
 - a. Use standard JPS pipe label colors
 2. Sanitary Waste and Storm Drainage Piping:
 - a. Use standard JPS pipe label colors

Service	Color (Pipe/Background/Text)	Designation
Domestic Cold Water	Green/Green/White	DCW
Domestic Hot Water	Orange/Yellow/Black	DHW
Domestic Hot Water Recirculation	Orange/Yellow/Black	DHWR
Sanitary Drain	No color/Yellow/Black	SAN
Storm Drain	No color/White/Black	STORM
Sanitary Vent	No color/Blue/White	VENT

END OF SECTION

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - 2. Jacket Materials for Pipe: 12 inches long by NPS 2
 - 3. Sheet Jacket Materials: 12 inches square.
 - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- D. Qualification Data: For qualified Installer.
- E. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- F. Field quality-control reports.

1.3 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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 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.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.
- 1.4 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.
- 1.5 COORDINATION
 - A. Coordinate sizes and locations 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. 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.
- 1.6 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 "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation 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.
 - D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
 - E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
 - F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
 - G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
 - H. 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-Degree 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. 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. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Thermokote V.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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 LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- D. ASJ Adhesive, and FSK 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mildry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mildry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mildry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 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.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.6 SEALANTS

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 5. Color: White or gray.
 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Use sealants 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," including 2004 Addenda.
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Use sealants 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," including 2004 Addenda.

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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: Color-code jackets based on system.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

- A. FSK Tape: Foil-face, 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. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inchwide with wing seal or closed seal.
 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inchnickel-copper alloy 0.062-inchsoft-annealed, stainless steel 0.062-inchsoft-annealed, galvanized steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. McGuire Manufacturing.
 - c. Plumberex.
 - d. Truebro; a brand of IPS Corporation.
 - e. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. 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. Follow all manufacturers' installation instructions for insulation.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- D. 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.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. 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.

- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. 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. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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.
- C. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

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 and polyolefin, 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. 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.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- 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 INSTALLATION OF MINERAL-FIBER INSULATION

- 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.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, 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 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by

insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. 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.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulate piping systems in accordance with latest edition of International Energy Conservation Code (IECC) and ASHRAE standard 90.1. Insulation thicknesses provided below are minimums and may require increase to comply. 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.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. With Zeston fittings on all Tees, 90 degree elbows, and 45 degree elbows.
 - 2. NPS 1-1/4and Larger: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. With Zeston fittings on all Tees, 90 degree elbows, and 45 degree elbows.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4and Smaller: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. With Zeston fittings on all Tees, 90 degree elbows, and 45 degree elbows.
 - 2. NPS 1-1/2and Larger: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. With Zeston fittings on all Tees, 90 degree elbows, and 45 degree elbows.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for

People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 1. None.
- D. Piping, Exposed in mechanical rooms, janitor closets and storage spaces at 10 ft and lower:
 1. Aluminum, Smooth: 0.016 inch thick.
- E. Piping, Exposed in other areas:
 1. PVC, Color-Coded by System: 20 mils thick.

END OF SECTION

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

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 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- 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.
- F. Copper Tube, Pressure-Seal-Joint Fittings:
 - 1. Fittings for NPS 2 and Smaller: Cast-brass, cast-bronze, or wrought-copper with EPDM-rubber, O-ring seal in each end.
 - 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 - 3. Minimum 200-psigworking-pressure rating at 250 deg F.

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.

- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 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. HART Industrial Unions, LLC.
 - b. Watts; a Watts Water Technologies company.
 - c. Wilkins.
 - 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. Matco-Norca.
 - b. Watts; a Watts Water Technologies company.
 - c. Wilkins.
 - 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.
- D. Dielectric-Flange Insulating Kits:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - 2. Nonconducting materials for field assembly of companion flanges.
 - 3. Pressure Rating: 150 psig.
 - 4. Gasket: Neoprene or phenolic.
 - 5. Bolt Sleeves: Phenolic or polyethylene.
 - 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grinnell Mechanical Products.
 - b. Matco-Norca.
 - c. Precision Plumbing Products.
 - 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 - 5. End Connections: Male threaded or grooved.
 - 6. Lining: Inert and noncorrosive, propylene.

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 domestic water piping level without pitch and plumb.
- D. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- E. Install piping concealed from view and protected from physical contact by building occupants unless

otherwise indicated and except in equipment rooms and service areas.

- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. 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.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- M. 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."
- N. 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."
- O. 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."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Use only one piece escutcheons.

3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball valves..
 - 2. Throttling Duty: Use bronze ball valves.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2and smaller and butterfly valves for piping NPS 2-1/2and larger.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Plumbing Specialties."

3.3 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. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

- E. 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."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- 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.

3.4 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 or unions.

3.5 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 couplings or nipples.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Support vertical piping and tubing at base and at each floor.
- B. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- C. 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.
- D. Install supports for vertical copper tubing every 10 feet.
- E. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.9 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.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 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.

3.11 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.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 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. Press type fittings may be used on aboveground copper tubing except for hot water recirculation lines.
- E. Aboveground domestic water piping, NPS 2 and smaller (except hot water recirculation piping, NPS 1 and smaller), shall be one of the following:
 - 1. Drawn-temper copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 - 2. Drawn-temper copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- F. Aboveground domestic hot water recirculating piping, NPS 1 and smaller, shall be the following:
 - 1. Drawn-temper copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 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-dvv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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: ASTM A 888 or CISPI 301.
- B. Extra Heavy-Duty, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and ASTM C 1540.
 - 2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop. Minimum 4 band couplings.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. Dallas Specialty & Mfg. Co.
 - c. Mission Rubber Company, LLC; a division of MCP Industries.
 - d. Stant.
 - 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. Minimum 4 band couplings.

2.4 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of

- different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Mission Rubber Company, LLC; a division of MCP Industries.
 - 3) Plastic Oddities.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 4. Shielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company, LLC; a division of MCP Industries.
 - b. Standard: ASTM C 1460.
 - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 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. 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.
- I. 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.
- J. 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; 2 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.

- K. 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."
- L. Plumbing Specialties:
 - 1. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- N. 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."

3.2 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.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- 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. 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 supports for vertical copper tubing every 10 feet.
- G. 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 soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. 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. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 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.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- 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. 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 separate report for each test, complete with diagram of portion of piping tested.
 - 2. 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.
 - 3. 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.
 - 4. 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.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.7 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.

3.8 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 3. All underground piping to be supported with a pipe void hanger system (by Supervoid or approved equal). Only applicable to void form slab construction.

END OF SECTION

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Miscellaneous sanitary drainage piping specialties.
 - 5. Flashing materials.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Cast-Iron Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Zurn Industries, LLC.
 - c. Tyler Pipe; a subsidiary of McWane Inc
 - 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Heavy-duty, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Required.
 - 7. Outlet Connection: Spigot.
 - 8. Closure: Brass plug with tapered threads.
 - 9. Adjustable Housing Material: Cast iron with set-screws or other device.
 - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 11. Frame and Cover Shape: Round.
 - 12. Top Loading Classification: Heavy Duty.
 - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

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.
 - b. Zurn Industries, LLC.
 - c. Tyler Pipe; a subsidiary of McWane Inc.
 - 2. Standard: ASME A112.6.3 with backwater valve.
 - 3. Pattern: Area drain.
 - 4. Body Material: Gray iron.
 - 5. Seepage Flange: Required.
 - 6. Anchor Flange: Required.
 - 7. Clamping Device: Required.
 - 8. Outlet: Side.
 - 9. Trap guard required on all floor drains and floor sinks.
 - 10. Coating on Interior and Exposed Exterior Surfaces: Not required.

11. Sediment Bucket: Not required.
12. Top or Strainer Material: Gray iron.
13. Top of Body and Strainer Finish: Rough bronze.
14. Top Shape: Square.
15. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
16. Trap Material: Cast iron.
17. Trap Pattern: Standard P-trap.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies :
 1. Alcorn Engineering Company, Thaler Metal Industries, LTD, Zurn Industries, LLC.
 2. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. 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.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. 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.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. 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.
 - E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
 - F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
 - G. 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.
 - H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
 - I. Install vent caps on each vent pipe passing through roof.
- 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.
- 3.3 FLASHING INSTALLATION
- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
 - C. Set flashing on floors and roofs in solid coating of bituminous cement.
 - D. Secure flashing into sleeve and specialty clamping ring or device.
 - E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- 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

SECTION 224000

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.2 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.3 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in operation maintenance manuals.

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"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Hand Sinks: NSF 2 construction.
 - 3. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
 - 4. Vitreous-China Fixtures: ASME A112.19.2M.
 - 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucet Hose: ASTM D 3901.
 - 5. Faucets: ASME A112.18.1M.
 - 6. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 7. Hose-Coupling Threads: ASME B1.20.7.
 - 8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 9. NSF Materials: NSF 61.
 - 10. Pipe Threads: ASME B1.20.1.
 - 11. Supply and Drain Fittings: ASME A112.18.1M.
 - J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1M.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
 - K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.21.1M.
 - 2. Hose-Coupling Threads: ASME B1.20.7.
 - 3. Pipe Threads: ASME B1.20.1.
 - 4. Plastic Toilet Seats: ANSI Z124.5.
- 1.5 COORDINATION
- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.
- 1.6 EXTRA MATERIALS
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
 - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
 - 3. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
 - 4. Supply, Flow-Control Fittings: Equal to 5 percent of amount of each type and size installed.
 - 5. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.
 - 6. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall provide plumbing fixtures where indicated on the Drawings. These plumbing fixtures shall be standard products as manufactured by manufacturers indicated on the schedule. The fixtures shall be free from mars or chips and shall be new, first quality and shall be furnished with sufficient supports in order to adequately hang each and every unit. The space between fixtures and masonry walls shall be grouted with White General Electric Silicone flexible grout. The space between fixtures and sheetrock or wood panel walls shall not be grouted but the fixture shall fit flat against the wall surface with no more than 1/16" gap.
- B. All faucets, fittings, supply stops and similar devices shall be of one manufacturer unless otherwise specified. All water faucets and valve bodies shall be cast brass with a minimum copper content of 85%. They shall contain standardized interchangeable operating units constructed of a removable and
- C. replaceable unit containing all parts subject to wear. All water faucets shall contain an adjustable internal volume control unit. All exposed parts shall be chromium plated.
- D. All fixtures shall meet the requirements of ADA, ANSI A117.1, ANSI Z124.2 and the State of Texas

Accessibility Standards (TAS).

- E. See drawings for schedule of fixtures.

2.2 FITTINGS AND PIPES:

- A. Fittings and piping shall be brass and, wherever exposed, shall be polished chrome-plated. Provide tight fitting wall or floor escutcheons of chrome-plated brass wherever pipes pass through floors, walls or ceilings.
- B. Furnish and install all required water, waste, soil and vent connections to all plumbing fixtures, together with all fittings, supports, fastening devices, cocks, valves, traps, etc., leaving all in complete working order.
- C. Supplies for all lavatories, sinks, tank type water closets and drinking fountains shall be loose key angle stops with $\frac{1}{2}$ " I.P.S. female inlets and shall include wall flanges, and $\frac{1}{2}$ " O.D. flexible risers with bull-nose or flared end outlets,. All components to be chrome-plated. In all cases, all piping, tubing, fittings, and faucets shall be installed using a mechanical non-slip connection, such as bull-nose, flared, flanged, ferrule or threaded fittings. Fittings requiring a friction fit using slip-on or gasketed connections are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 - 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-hanging 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-hanging fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
- G. 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.
 - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture.
 - 2. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- I. 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.
- J. Install toilet seats on water closets.
- K. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- L. 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.
- M. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

- N. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- O. 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.
- P. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures. Provide shut off valves on all branch lines.
- C. Connect drain piping from fixtures to drainage piping.
- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed 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.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
- D. 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.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224019

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following plumbing specialties:
 - 1. Balancing valves.
 - 2. Thermostatic water mixing valves.
 - 3. Trap seal primer valves.
 - 4. Miscellaneous piping specialties.
 - 5. Flashing materials.
 - 6. Cleanouts.
 - 7. Floor drains.

1.2 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PUR: Polyurethane plastic.
 - 4. PVC: Polyvinyl chloride plastic.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig.
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water.
 - 3. Storm Drainage Piping: 10-foot head of water.
 - 4. Force-Main Piping: 100 psig.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 - 1. Balancing valves, water filters, and strainers.
 - 2. Thermostatic water mixing valves and water tempering valves.
 - 3. Water hammer arresters, air vents, and trap seal primer valves and systems.
 - 4. Cleanouts, floor drains, open receptors, trench drains, and roof drains.
 - 5. Vent caps, vent terminals, and roof flashing assemblies.
 - 6. Sleeve penetration systems.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 - 1. Backflow preventers and water regulators.
 - 2. Thermostatic water mixing valves and water tempering valves.
 - 3. Hose hydrants.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated.
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 - 1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

1.7 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

1.8 BALANCING VALVES

- A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
 - 1. Manufacturers:
 - a. Taco, Inc.
 - 2. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
 - 3. NPS 2-1/2 and Larger: Cast-iron, Y-pattern body with bronze disc and flanged ends.

1.9 THERMOSTATIC WATER MIXING VALVES

- A. Manufacturers:
 - 1. Armstrong Rada company
- B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.
 - 1. Type: Bimetal thermostat, operation and pressure rating 125 psig minimum.
- C. Thermostatic Water Mixing Valves: Unit, with the following:
 - 1. Piping, valves, and unions.
 - 2. Piping Component Finish: Rough bronze.
 - 3. Cabinet: Recessed-mounting steel box with steel hinged door, white enameled finish, and thermometer in front.
- D. Manifolder, Thermostatic Water Mixing-Valve Assemblies: Factory-fabricated unit consisting of parallel arrangement of thermostatic water mixing valves.
 - 1. Arrangement: One large-flow, thermostatic water mixing valve with flow-control valve, pressure regulator, inlet and outlet pressure gages, and one small-flow, thermostatic water mixing valve with flow-control valve. Include outlet thermometer, factory- or field-installed inlet and outlet valves, and other indicated options.
 - 2. Include piping, valves, and unions.
 - 3. Piping Component Finish: Rough bronze.
 - 4. Cabinet: Recessed-mounting steel box with steel hinged door, white enameled finish, and thermometer in front.
- E. Control-Interface Features:
 - 1. Remote Alarm Contacts: For remote alarm interface.
 - 2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system (BACNet) to allow feedback and setpoint control.

1.10 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
 - 1. Manufacturers:
 - a. Smith, Jay R. Mfg. Co.
- B. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft, 0.0625-inch-thick, lead flashing collar and skirt extending at least 6 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.
 - 1. Manufacturers:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - 2. Open-Top Vent Cap: Without cap.
- C. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- D. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- E. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

1.11 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft, 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft.
 - 2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

1.12 CLEANOUTS

- A. Cleanouts, C.O.: Comply with ASME A112.3.1.
 - 1. Application: Floor cleanout, wall cleanout, or exposed piping.
 - 2. Manufacturers:
 - a. Smith, Jay R. Mfg. Co.
 - 3. Body or Ferrule Material: Cast iron.
 - 4. Clamping Device: Required.
 - 5. Outlet Connection: Spigot.
 - 6. Closure: Brass plug with straight threads and gasket.
 - 7. Adjustable Housing Material: Cast iron with threads.
 - 8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 - 9. Frame and Cover Shape: Round except in tile floors where square tops shall be used.

1.13 FLOOR DRAINS

- A. Floor drains shall be provided with deep seal "P" traps at all floor drains.

PART 3 - EXECUTION

1.14 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. 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.
- C. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- D. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- E. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- F. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- G. 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.
- H. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- I. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- J. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- K. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty ball, butterfly, check, gate, and globe valves.
- L. Install air vents at piping high points. Include ball, gate, or globe valve in.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- N. 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.

1.15 CONNECTIONS

- A. Piping installation requirements are specified in other specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Connect plumbing specialties and devices that require power according to Division 26 Sections.

1.16 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

1.17 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 230510

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Mechanical Demolition
 - 2. Equipment installation requirements common to equipment sections.
 - 3. Supports and anchorages.

1.2 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.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- 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.

1.3 QUALITY ASSURANCE

- A. Electrical Characteristics for Mechanical Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the "Alternate Manufacturer Evaluation Form", subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical 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 mechanical items requiring access that are concealed behind finished surfaces.
 - a.

PART 2 - EXECUTION

2.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 2. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 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.
- 2.2 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 mechanical 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.
- 2.3 PAINTING
- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- 2.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES
- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
 - B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
 - C. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Elastomeric hangers.
 - 11. Spring hangers.
 - 12. Snubbers.
 - 13. Restraint channel bracings.
 - 14. Restraint cables.
 - 15. Seismic-restraint accessories.
 - 16. Mechanical anchor bolts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
 - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 90 MPH.

2. Building Classification Category: III.
3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: C.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.5.
 - c. Component Amplification Factor: 1.0.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
2. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with threaded mounting holes and internal leveling device.

2.7 RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
 2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
 - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top plate with elastomeric pad.
 - c. Internal leveling bolt that acts as blocking during installation.
 3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
 4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
 2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.
1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
 2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.12 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
 2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.13 SNUBBERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Isolation Technology, Inc.
 - b. Kinetics Noise Control, Inc.
 - c. Mason Industries, Inc
- B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-

- wedge type.
- 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
- 3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.14 RESTRAINT CHANNEL BRACINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-line, an Eaton business.
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
- B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.15 RESTRAINT CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control, Inc.
 - 2. Loos & Co., Inc.
 - 3. Mason Industries, Inc.
- B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.16 SEISMIC-RESTRAINT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. B-Line, an Eaton business.
 - 2. Kinetics Noise Control, Inc.
 - 3. Mason Industries, Inc.
- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

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

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in

Section 033053 "Miscellaneous Cast-in-Place Concrete."

- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- D. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- J. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.
- 3.5 ADJUSTING
- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates.
 - 2. Equipment markers.
 - 3. Access panel and door markers.
 - 4. Pipe markers.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Valve schedules.
 - 8. Warning tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

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 location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal with data engraved or stamped or 2 or 3 ply laminated layers of engraving plastic for permanent attachment on equipment. Minimum 1/8 inch thick. Minimum size is ¾ inch by 2.5 inches.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: Mechanical. No adhesives.
 - 4. Colors shall comply with JPS standards.
- B. Equipment Markers: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2. Fabricate in sizes required for message
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - b. Equipment service.

- c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
- 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- 4. Fasteners: Self-tapping, stainless-steel screws.
- C. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with JPS standard color scheme:
 - a. See table below.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect or Engineer. Provide 5/32-inch hole for fastener.
 - 1. Material: 0.032-inch- thick brass or aluminum.
 - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.4 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size 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-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 - 2. Frame: Extruded aluminum.
 - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.5 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: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

2.6 TAG IDENTIFICATION SCHEME FOR LOCATING HIDDEN COMPONENTS

- A. Tag system to allow easy identification of the location of components and equipment that are not visible from the finished space and are accessible from the ceiling grid. Provide laminated, clear, adhesive printed tags to be fastened flush with acoustical ceiling. Tags shall be clear background with black letters 3/8" high, each tag bearing the equipment tag. Concealed equipment to be tagged shall include but not limited to the following:
 - 1. Exhaust fans.
 - 2. VAV terminal units and control valves.

3. Piping isolation valves.
4. Ductless split-system air-handling units.

2.7 UNDERGROUND RIBBON MARKING TAPE

- A. Detectable underground utility marking tape shall consist of a minimum 5mil overall thickness, five-ply composition; ultra high molecular weight, 100% virgin polyethylene; acid alkaline and corrosion resistant; with no less than 150 pounds of tensile break strength per 6" width.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.
- B. Locate ceiling tacks to locate valves above T-bar type and hard ceilings. Locate in corner of panel closest to equipment.
- C. All above ceiling valve and equipment locations are to have ceiling tags.
- D. All major equipment to have a QR Code on it for JPS tracking purposes – code generated by JPS
- E. All exposed piping is to be painted.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 1. Fans, blowers, and primary balancing dampers.
 2. Pumps
 3. Chillers
 4. Boilers
 5. Other major equipment
 6. Sound Attenuators
 7. HVAC Air Handling Units
- B. Install equipment markers with mechanical fasteners on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 1. Letter Size: Minimum 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.
 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Meters, gages, thermometers, and similar units.
 - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - g. Fans, blowers, primary balancing dampers, and mixing boxes.
 - h. Packaged HVAC central-station and zone-type units.
 - i. Tanks and pressure vessels.
 - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow. Minimum letter height is 1.5 inches.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible 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.
- C. Install underground ribbon marking tape midway between underground piping and the surface.
- D. Pipe Label Color Schedule:
1. All HVAC piping.
 - a. Use standard JPS pipe label colors

<u>Service</u>	<u>Color</u> <u>(Pipe/Background/Text)</u>	<u>Designation</u>
Primary Chilled Water Supply	Dark blue/Green/White	PCWS
Primary Chilled Water Return	Light Blue/Green/White	PCWR
Secondary Chilled Water Supply	Dark blue/Green/White	SCWS
Secondary Chilled Water Return	Light Blue/Green/White	SCWR
Primary Heating Water Supply	Dark Green/Green/White	PHWS
Primary Heating Water Return	Light green/Green/White	PHWR
Secondary Heating Water Supply	Dark Green/Green/White	SHWS
Secondary Heating Water Return	Light green/Green/White	SHWR
Refrigerant Liquid	No color/White/Black	RL
Refrigerant Suction	No color/White/Black	RS
A/C Condensate Drain	White/Yellow/Black	A/C
Makeup Water	Dark Green/Green/White	MU
Drain	White/White/Black	D

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; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections. 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:
1. Valve-Tag Size, shape, and color:

- a. 1-1/2 inches, round, natural color.

3.5 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- D. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

1.4 INFORMATIONAL SUBMITTALS

- A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate

system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- I. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- J. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Clean filters are installed.
 - b. Fans are operating, free of vibration, and rotating in correct direction.
 - c. Variable-frequency controllers' startup is complete and safeties are verified.
 - d. Automatic temperature-control systems are operational.
 - e. Ceilings are installed.
 - f. Windows and doors are installed.
 - g. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.

- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
 - 5.

3.6 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.

- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

- g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
 - E. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
 - F. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- 3.8 VERIFICATION OF TAB REPORT
 - A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.
 - B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
 - E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.
 - F. Prepare test and inspection reports.

3.9 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. CertainTeed Corporation, Johns Manville; a Berkshire Hathaway Company, Knauf Insulation, Owens Corning.
- E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.

d. Manson Insulation Inc.

2.2 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Foster Brand; H. B. Fuller Construction Products.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with

ASTM C 1136, Type II.

5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Adhesive: As recommended by jacket material manufacturer.
 2. Color: White.
- D. Metal Jacket:
 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.7 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, galvanized steel.

2.9 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof 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 roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. 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.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping."
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- 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.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air.
- B. Items Not Insulated:
 1. Factory-insulated flexible ducts.
 2. Factory-insulated plenums and casings.
 3. Flexible connectors.
 4. Vibration-control devices.
 5. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density.
- B. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-Fiber Board Insulation, 2 inches thick and 3-lb/cu. ft. nominal density with FSK jacket.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Ducts and Plenums, Concealed:
 1. None.
- C. Ducts and Plenums, Exposed in mechanical rooms, janitor closets and storage spaces at 10 ft and lower:
 1. Aluminum, Smooth: 0.024 inch thick.
- D. Ducts and Plenums, Exposed in occupied spaces:
 1. FSK Jacket

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning is the process for ensuring that the HVAC System is installed and performs interactively according to the basis of design criteria and meets the building operational performance expectations as defined in the sequences of operations. The process also provides adequate documentation of installation, start-up and functional testing and ensures that the Owner's maintenance personnel are adequately trained. It provides for discovery of system operational performance deficiencies prior to substantial completion while the responsible contractors can provide a timely response. It establishes testing and communication protocols in an effort to advance the HVAC System from installation to complete dynamic operation and optimization.
- B. The commissioning process involves all the parties involved in the design and construction process as well as the Owner and the Commissioning Agent (CxA). Primary elements of Commissioning during the construction, acceptance and warranty phases of the project include:
 - 1. Verify applicable equipment and systems are installed in accordance with manufacturers' instructions and contract documents and receive adequate operational start-up checkout by installing contractors.
 - 2. Demonstrate functional operational performance of equipment and systems in the commissioning program.
 - 3. Verify O&M documentation submitted is complete. Provide required documentation and information to the Construction Manager to allow compilation of Building Systems Manuals.
 - 4. Verify Owner's maintenance personnel are adequately trained in accordance with specified training plan requirements.
 - 5. Verify systems are interacting and performing optimally in accordance with the system sequence of operations.
 - 6. Furnish labor and material to accomplish HVAC system commissioning and systems' testing as specified herein and other related sections.

1.2 RELATED SECTIONS

- A. Section 01 91 13 – General Commissioning Requirements.
- B. Section 01 91 14 – Functional Test Procedures
- C. Division 23 Sections pertaining to the HVAC Systems included in the commissioning program.

1.3 SUBMITTALS

- A. Refer to Section 01 91 13 for commissioning submittal requirements. Provide copies of commissioning submittal requirements to the Commissioning Agent, in addition to the copies required by the Owner and Design Professional.

1.4 COORDINATION

- A. The installation schedule for the components, systems and equipment included in the commissioning program shall be such that the commissioning requirements can be met without impacting the construction schedule. Commissioning Functional Performance Testing is a requirement for Substantial Completion.
- B. All maintenance points for components installed by the contractor (or sub-contractors) for building systems servicing shall be flagged utilizing construction marker ribbons if the maintenance point is located where multiple trades will be installing systems, unobstructed access from floor level shall be maintained. Refer to Section 01 91 13 for additional information on maintenance/service point access.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Trade contractors shall provide all specialized tools, test equipment, and instruments required to execute

startup, checkout, field calibration and functional performance testing of equipment under their contract.

- B. Test equipment shall be of sufficient quality and accuracy (great accuracy than specified for component) to test and/or measure system performance according to specified tolerances. Test equipment is to have calibrated within the previous 12 months. Calibration shall be NIST traceable. Equipment shall be re-calibrated when dropped or damaged. Calibration tags shall be affixed or certificates be readily available.
- C. Datalogging equipment or software required to test equipment may also be provided by the CxA as needed but shall not become the property of the Owner.

PART 3 - EXECUTION

3.1 COMMISSIONING

- A. General Requirements. For additional information regarding general commissioning requirements refer to Section 01 91 13.
- B. Installation contractors shall be responsible for executing and documenting equipment installation, start-up and check out for systems and equipment by completing the associated Pre-Functional (installation) Checklists (PFCs). Contractors shall also be responsible for executing and documenting contractor pretesting. Documentation of these efforts shall be provided to the Commissioning Agent (CxA) prior to scheduling the Functional Performance Test (FPT). Contractors shall also be responsible for providing training for the Owner's maintenance personnel in accordance with project requirements.
- C. Installation and Start-Up Contractor Pre-Functional Checklist (PFC) for each type of equipment and system shall be provided to the installation contractors by the Commissioning Agent for use by the contractors in documenting the installation and start-up of equipment in the commissioning program.
- D. For equipment and system components requiring a manufacturer's representative for installation verification and start-up, manufacturer documentation of these activities shall be attached to the Pre-Functional checklists (PFCs) provided by the Commissioning Agent.
- E. Functional Performance Test (FPT) procedures for each type of equipment and system shall be made available to the installation contractors by the Commissioning Agent for use by the contractor in documenting their pretesting effort. Refer to Section 01 91 14 for further information.
- F. Completed Start-up and Pre-Functional checklists and Contractor pre-testing documentation for all pieces of equipment shall be submitted by contractors to the Commissioning Agent through the General Contractor prior to the scheduling of the final Functional Performance Test that is witnessed by the CxA

3.2 TRAINING

- A. Contractor responsible for the installation of the system shall coordinate the participation of other sub-contractors and manufacturer's representatives in the training program in accordance with requirements of the project specifications.

3.3 Operations and maintenance data

- A. Contractor responsible for the installation of the system shall provide operations and maintenance manuals in accordance with requirements of other sections of the project specifications

3.4 GENERAL SYSTEM TESTING CRITERIA

- A. Functional Performance Testing
 - 1. Refer to Sections 01 91 13 - General Commissioning Requirements and 01 91 14 - Functional Testing Requirements. Installation contractor shall be responsible for providing authorized manufacturer's representatives to demonstrate the operational capabilities of the equipment systems as needed.

END OF SECTION

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round and flat-oval ducts and fittings.
 - 3. Acoustic Duct Liner
 - 4. Sheet metal materials.
 - 5. Sealants and gaskets.
- B. Related Sections:
 - 1. Division 1 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.3 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Sealants and gaskets.
 - 2. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment, seismic restraints (if required), and vibration isolation.
- C. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Ductwork on site shall be stored indoors and above ground.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction

Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Solvent-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Base: Synthetic rubber resin.
 - 3. Solvent: Toluene and heptane.
 - 4. Solids Content: Minimum 60 percent.
 - 5. Shore A Hardness: Minimum 60.
 - 6. Water resistant.
 - 7. Mold and mildew resistant.
 - 8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 - 10. Service: Indoor or outdoor.
 - 11. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 ACOUSTIC DUCT LINER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. K-flex DUCT Liner Gray elastomeric or approved equal. Glass fiber insulation is not acceptable.
- B. Install per manufacturer's instructions.
- C. Concealed or Exposed Duct: Install 2- inch thick acoustic duct liner only where shown on Drawings.
- D. Treat edges of shop fabrication and field cuts.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:

- a. Supply Ducts (Medium Pressure): Test 100% of the medium pressure supply ductwork.
 - b. Supply, Return, & Exhaust Ducts: Test one long section of a low pressure supply, return, and exhaust duct. If leakage test passes, remaining low pressure duct will be inspected only.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 6. Give seven days' advance notice for testing.
 - C. Duct System Cleanliness Tests:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
 - D. Duct system will be considered defective if it does not pass tests and inspections.
 - E. Prepare test and inspection reports.
- 3.7 START UP
- A. Air Balance: Comply with requirements in Division 1 Section for Testing, Adjusting, and Balancing of HVAC systems.
- 3.8 DUCT SCHEDULE
- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - B. Supply Ducts:
 1. Ducts Connected downstream of VAV Terminal Units, including outdoor air intake and relief air:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 2. Ducts Connected to Variable-Air-Volume Air-Handling Units (upstream of VAV Terminal Units):
 - a. Pressure Class: Positive 3-inch wg
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - C. Return Ducts:
 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - D. Exhaust Ducts:
 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - E. Elbow Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round and Oval Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- F. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."
 - a. Velocity 1500 fpm or Lower: Conical tap.
 - b. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manual volume dampers.
 - 2. Control dampers.
 - 3. Fire dampers.
 - 4. Flange connectors.
 - 5. Turning vanes.
 - 6. Remote damper operators.
 - 7. Duct-mounted access doors.
 - 8. Flexible connectors.
 - 9. Flexible ducts.
 - 10. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.4 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Match adjacent ductwork.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL VOLUME DAMPERS

- A. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. METALAIR, Inc.
 - b. Nailor Industries Inc.
 - c. Pottorff; a division of PCI Industries, Inc.
 - d. Ruskin Company.
 - e. Trox USA Inc.
 - 2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat shaped.
 - b. Stainless-steel channels, 0.064 inch thick.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Stainless, roll-formed steel, 0.064 inch thick.
 - 6. Blade Axles: Stainless steel.
 - 7. Bearings:
 - a. Molded synthetic or Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Blade Seals: Neoprene.
 - 9. Jamb Seals: Cambered stainless steel.
 - 10. Tie Bars and Brackets: Aluminum.
 - 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- B. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.3 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. METALAIRE, Inc.
 - 3. Nailor Industries Inc.
 - 4. Ruskin Company.
 - 5. Young Regulator Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
 - 1. Hat shaped.
 - 2. Stainless-steel channels, 0.064 inch thick.
 - 3. Mitered and welded corners.
- D. Blades:
 - 1. Multiple blade with maximum blade width of 8 inches
 - 2. Opposed-blade design.
 - 3. Stainless steel.
 - 4. 0.064 inch thick.
 - 5. Blade Edging: Closed-cell neoprene edging.
 - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch-diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
 - 1. Molded synthetic or Stainless-steel sleeve.
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.

2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. METALAIRE, Inc.
 - 3. Nailor Industries Inc.
 - 4. Pottorff; a division of PCI Industries, Inc.
 - 5. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners. Provide frames large enough to eliminate obstruction to airflow when the damper is open.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

- K. Access: Provide access door in ductwork for replacement of fusible links and damper-related accessories.

2.5 FLANGE CONNECTORS

- 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. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

- 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. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall. If greater than 36 inches use sections per SMACNA standards.

2.7 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment (required in areas with inaccessible ceilings).
- C. Tubing: Brass.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed, 2 inches deep.
- F. Wall-Box Cover-Plate Material: Stainless steel.

2.8 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Flexmaster U.S.A., Inc.
 3. Greenheck Fan Corporation.
 4. Nailor Industries Inc.
 5. Pottorff; a division of PCI Industries, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: Continuous piano hinge and cam latches.

- e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Hinges and two compression latches with outside and inside handles.
 - C. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
 - 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 - 4. Factory set at 10-inch wg.
 - 5. Doors close when pressures are within set-point range.
 - 6. Hinge: Continuous piano.
 - 7. Latches: Cam.
 - 8. Seal: Neoprene or foam rubber.
 - 9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.
- 2.9 DUCT ACCESS PANEL ASSEMBLIES
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
 - B. Labeled according to UL 1978 by an NRTL.
 - C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
 - D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
 - E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
 - F. Minimum Pressure Rating: 10-inch wg, positive or negative.
- 2.10 FLEXIBLE CONNECTORS
- A. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 ounce per square yard, approximately six (6) inches wide, crimped into metal edging strip. Provide electrical bonding jumpers across flexible connection. Fabricate per SMACNA HVAC Duct Construction Standards – Metal and Flexible.
 - B. Provide flexible duct connection on all rotating equipment.
- 2.11 FLEXIBLE DUCTS
- 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. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
 - 4. Insulation: Minimum (1) inch thick flexible glass fiber insulation enclosed by seamless aluminum pigmented plastic vapor barrier jacket. Comply with ASHRAE/IESNA 90.1-2004. Maximum 0.23 "k" value at 75 °F.
 - 5. Provide flexible duct hanger supports at four feet on center. Maximum sag not to exceed 1/2-inch per foot.

- C. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials.
- C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-footspacing.
 - 8. Upstream from turning vanes.
 - 9. Upstream from duct silencers.
 - 10. Control devices requiring inspection.
 - 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. 24 by 24 inches.
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts with rigid ductwork and flexible connectors. Do not use flexible ducts.
- N. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or

strapped in place.

- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.
- Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Shutoff single-duct air terminal units.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Contract Closeout," include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.3 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- D. Store units indoors, above floor, with covered ends to prevent damage and entrance of dirt, debris, and moisture.

1.4 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ENVIRO-TEC; by Johnson Controls, Inc.
 - 2. Metalaire Industries.
 - 3. Price
 - 4. Titus
- B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.
- C. Casing: 0.034-inch steel.
 - 1. Casing Lining: 3/4-inch-thick, flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
 2. Damper Position: Normally closed.
- E. Attenuator Section: 0.034-inch steel sheet.
1. Mixing type attenuator to decrease unit length.
 2. Attenuator Section Liner: 3/4-inch-thick, flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- F. Factory-Mounted and -Wired Controls: The terminal unit manufacturer shall provide the following components for each VAV terminal unit for interface and mounting of the UC (Unitary Controller):
1. Primary air dampers to be controlled by the UC.
 2. Enclosure to house the UC and associated components or suitable mounting brackets within the terminal unit enclosure.
 3. Single point connection.
 4. Disconnect.
 5. Multi-point averaging type flow sensor at the primary air inlet to the terminal unit.
 6. The DDC Controls subcontractor shall furnish to the terminal unit manufacturer the unitary controller and damper actuator. The DDC Controls subcontractor shall field install the 24V transformer, room temperature sensor, and discharge air temperature sensor.
- G. DDC Controls: DDC Controls shall be furnished by the DDC Controls subcontractor and installed at the terminal unit factory.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

- A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- B. Ground units according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power conductors and Cables."
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 2. Leak Test: After installation, fill water coils 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 motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 1 Section "Closeout Procedures" and "Demonstration and Training."

END OF SECTION

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles:
 - 1. Regular Service
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
 - 3. Include fastening method for behavioral health diffusers, registers, and grilles.

PART 2 - PRODUCTS

2.1 STANDARD DIFFUSERS, REGISTERS, AND GRILLES

- A. Basis of Design: Scheduled grilles and diffusers are the standard of quality, features and performance. Suppliers may offer products that are equivalent in quality of construction, features, performance. The Engineer shall be the sole judge of the equivalence of products other than those scheduled.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
 - 1. METALAIRE, Inc.; Metal Industries Inc.
 - 2. Titus.
 - 3. Airmate.
 - 4. Price
- C. Diffusers, registers, and grilles scheduled on the Drawings to be insulated shall be insulated with closed cell insulation. Fibrous insulation is not acceptable. All supply air diffusers to have insulated backs.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as

much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 260010

SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies supplemental requirements generally applicable to the Work specified in Division 26. This Section is also referenced by related Work specified in other Divisions.
- B. Related Requirements:
 - 1. Section 260011 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 REFERENCES

- A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:
 - 1. 8P8C: An 8-position 8-contact modular jack.
 - 2. A: Ampere, unit of electrical current.
 - 3. AC or ac: Alternating current.
 - 4. AFCI: Arc-fault circuit interrupter.
 - 5. AIC: Ampere interrupting capacity.
 - 6. AL, Al, or ALUM: Aluminum.
 - 7. ASD: Adjustable-speed drive; also called variable-frequency drive (VFD).
 - 8. ATS: Automatic transfer switch.
 - 9. AWG: American wire gauge; see ASTM B258.
 - 10. BAS: Building automation system.
 - 11. BIL: Basic impulse insulation level.
 - 12. BIM: Building information modeling.
 - 13. CAD: Computer-aided design or drafting.
 - 14. CATV: Community antenna television.
 - 15. CB: Circuit breaker.
 - 16. cd: Candela, the SI fundamental unit of luminous intensity.
 - 17. CO/ALR: Copper-aluminum, revised.
 - 18. COPS: Critical operations power system.
 - 19. CU or Cu: Copper.
 - 20. CU-AL or AL-CU: Copper-aluminum.
 - 21. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
 - 22. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
 - 23. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
 - 24. dBm: Decibel absolute power with respect to 1 mW.
 - 25. DC or dc: Direct current.
 - 26. DCOA: Designated critical operations area.
 - 27. DDC: Direct digital control (HVAC).
 - 28. EGC: Equipment grounding conductor.
 - 29. ELV: Extra-low voltage.
 - 30. EMF: Electromotive force.
 - 31. EMI: Electromagnetic interference.
 - 32. EPM: Electrical preventive maintenance.
 - 33. EPS: Emergency power supply.
 - 34. EPSS: Emergency power supply system.
 - 35. ESS: Energy storage system.
 - 36. EV: Electric vehicle.
 - 37. EVPE: Electric vehicle power export equipment.
 - 38. EVSE: Electric vehicle supply equipment.
 - 39. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion $1 \text{ fc} = 10 \text{ lx}$ in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.

- 40. FLC: Full-load current.
- 41. ft: Foot.
- 42. ft-cd: Foot-candle, the antiquated U.S. Standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" after the SI unit candela (cd) replaced the international candle; see "fc,"
- 43. GEC: Grounding electrode conductor.
- 44. GFCI: Ground-fault circuit interrupter.
- 45. GFPE: Ground-fault protection of equipment.
- 46. GND: Ground.
- 47. HACR: Heating, air conditioning, and refrigeration.
- 48. HDPE: High-density polyethylene.
- 49. HID: High-intensity discharge.
- 50. HP or hp: Horsepower.
- 51. HVAC: Heating, ventilating, and air conditioning.
- 52. Hz: Hertz.
- 53. IBT: Intersystem bonding termination.
- 54. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
- 55. IP: Ingress protection rating (enclosures); Internet protocol (communications).
- 56. IR: Infrared.
- 57. IS: Intrinsically safe.
- 58. IT&R: Inspecting, testing, and repair.
- 59. ITE: Information technology equipment.
- 60. kAIC: Kiloampere interrupting capacity.
- 61. kcmil or MCM: One thousand circular mils.
- 62. kV: Kilovolt.
- 63. kVA: Kilovolt-ampere.
- 64. kVA_r or kVAR: Kilovolt-ampere reactive.
- 65. kW: Kilowatt.
- 66. kWh: Kilowatt-hour.
- 67. LAN: Local area network.
- 68. lb: Pound (weight).
- 69. lbf: Pound (force).
- 70. LCD: Liquid-crystal display.
- 71. LCDI: Leakage-current detector-interrupter.
- 72. LED: Light-emitting diode.
- 73. Li-ion: Lithium-ion.
- 74. lm: Lumen, the SI derived unit of luminous flux.
- 75. LNG: Liquefied natural gas.
- 76. LP-Gas: Liquefied petroleum gas.
- 77. LRC: Locked-rotor current.
- 78. LV: Low voltage.
- 79. lx: Lux, the SI derived unit of illuminance equal to one lumen per square meter.
- 80. m: Meter.
- 81. MCC: Motor-control center.
- 82. MDC: Modular data center.
- 83. MG set: Motor-generator set.
- 84. MIDI: Musical instrument digital interface.
- 85. MLO: Main lugs only.
- 86. MV: Medium voltage.
- 87. MVA: Megavolt-ampere.
- 88. mW: Milliwatt.
- 89. MW: Megawatt.
- 90. MWh: Megawatt-hour.
- 91. NC: Normally closed.
- 92. Ni-Cd: Nickel-cadmium.
- 93. Ni-MH: Nickel-metal hydride.
- 94. NIU: Network interface unit.
- 95. NO: Normally open.
- 96. NPT: National (American) standard pipe taper.
- 97. OCPD: Overcurrent protective device.
- 98. ONT: Optical network terminal.
- 99. PC: Personal computer.

- 100. PCS: Power conversion system.
- 101. PCU: Power-conditioning unit.
- 102. PF or pf: Power factor.
- 103. PHEV: Plug-in hybrid electric vehicle.
- 104. PLC: Programmable logic controller.
- 105. PLFA: Power-limited fire alarm.
- 106. PoE: Power over Ethernet.
- 107. PV: Photovoltaic.
- 108. PVC: Polyvinyl chloride.
- 109. pW: Picowatt.
- 110. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
- 111. RMS or rms: Root-mean-square.
- 112. RPM or rpm: Revolutions per minute.
- 113. SCADA: Supervisory control and data acquisition.
- 114. SCR: Silicon-controlled rectifier.
- 115. SPD: Surge protective device.
- 116. sq.: Square.
- 117. SWD: Switching duty.
- 118. TCP/IP: Transmission control protocol/Internet protocol.
- 119. TEFC: Totally enclosed fan-cooled.
- 120. TR: Tamper resistant.
- 121. TVSS: Transient voltage surge suppressor.
- 122. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.
- 123. UL CCN: UL Category Control Number.
- 124. UPS: Uninterruptible power supply.
- 125. USB: Universal serial bus.
- 126. UV: Ultraviolet.
- 127. V: Volt, unit of electromotive force.
- 128. V(ac): Volt, alternating current.
- 129. V(dc): Volt, direct current.
- 130. VA: Volt-ampere, unit of complex electrical power.
- 131. VAR: Volt-ampere reactive, unit of reactive electrical power.
- 132. VFC: Variable-frequency controller.
- 133. VOM: Volt-ohm-multimeter.
- 134. VPN: Virtual private network.
- 135. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
- 136. W: Watt, unit of real electrical power.
- 137. Wh: Watt-hour, unit of electrical energy usage.
- 138. WPT: Wireless power transfer.
- 139. WPTE: Wireless power transfer equipment.
- 140. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

- 1. CR: Communications raceway.
- 2. CR-GP: General-purpose communications raceway.
- 3. CR-P: Plenum communications raceway.
- 4. CR-R: Riser communications raceway.
- 5. EMT: Electrical metallic tubing.
- 6. EMT-A: Aluminum electrical metallic tubing.
- 7. EMT-S: Steel electrical metallic tubing.
- 8. EMT-SS: Stainless steel electrical metallic tubing.
- 9. ENT: Electrical nonmetallic tubing.
- 10. EPEC: Electrical HDPE underground conduit (thin wall).
- 11. EPEC-A: Type A electrical HDPE underground conduit.
- 12. EPEC-B: Type B electrical HDPE underground conduit.
- 13. ERMC: Electrical rigid metal conduit.
- 14. ERMC-A: Aluminum electrical rigid metal conduit.
- 15. ERMC-S: Steel electrical rigid metal conduit.
- 16. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
- 17. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
- 18. ERMC-SS: Stainless steel electrical rigid metal conduit.

19. FMC: Flexible metal conduit.
20. FMC-A: Aluminum flexible metal conduit.
21. FMC-S: Steel flexible metal conduit.
22. FMT: Steel flexible metallic tubing.
23. FNMC: Flexible nonmetallic conduit. See "LFNC."
24. HDPE: HDPE underground conduit (thick wall).
25. HDPE-40: Schedule 40 HDPE underground conduit.
26. HDPE-80: Schedule 80 HDPE underground conduit.
27. IMC: Steel electrical intermediate metal conduit.
28. LFMC: Liquidtight flexible metal conduit.
29. LFMC-A: Aluminum liquidtight flexible metal conduit.
30. LFMC-S: Steel liquidtight flexible metal conduit.
31. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
32. LFNC: Liquidtight flexible nonmetallic conduit.
33. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
34. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
35. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
36. PVC: Rigid PVC conduit.
37. PVC-40: Schedule 40 rigid PVC conduit.
38. PVC-80: Schedule 80 rigid PVC Conduit.
39. PVC-A: Type A rigid PVC concrete-encased conduit.
40. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
41. RGS: See ERM-C-S-G.
42. RMC: See ERM-C.
43. RTRC: Reinforced thermosetting resin conduit.
44. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
45. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
46. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
47. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
48. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.
4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.

31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.
42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.
56. SE: Service-entrance cable.
57. SER: Service-entrance cable, round.
58. SEU: Service-entrance cable, flat.
59. SIS: Thermoset cable for switchboard and switchgear wiring.
60. TBS: Thermoplastic cable with outer braid.
61. TC: Tray cable.
62. TC-ER: Tray cable, exposed run.
63. TC-ER-HL: Tray cable, exposed run, hazardous location.
64. THW: Thermoplastic, heat- and moisture-resistant cable.
65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
66. THHW: Thermoplastic, heat- and moisture-resistant cable.
67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
68. TW: Thermoplastic, moisture-resistant cable.
69. UF: Underground feeder and branch-circuit cable.
70. USE: Underground service-entrance cable.
71. XHH: Cross-linked polyethylene, heat-resistant cable.
72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Abbreviations and Acronyms for Electrical Flexible Cord Types:

1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
4. SEOWO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
6. SJEOO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant

- thermoset outer cover for damp locations.
10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
 11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
 12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
 13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
 14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
 15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
 16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
 17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
 18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
 19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
 20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
 21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
 22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.
 23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
 24. STOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

E. Definitions:

1. 8-Position 8-Contact (8P8C) Modular Jack: An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Also called a "TIA-1096 miniature 8-position series jack" (8PSJ), or an "IEC 8877 8-pole jack."
 - a. Be careful when suppliers use "RJ45" generically. Obsolete RJ45 jacks used for analog telephone cables have rejection keys. 8P8C jacks used for digital telephone cables and Ethernet cables do not have rejection keys.
2. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
3. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
4. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
5. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
6. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
7. Designated Seismic System: A system component that requires design in accordance with Ch. 13 of ASCE/SEI 7 and for which the Component Importance Factor is greater than 1.0.
8. Direct Buried: Installed underground without encasement in concrete or other protective material.
9. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is

- provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
- b. Concrete Box: A box intended for use in poured concrete.
 - c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - f. Device Box: A box with provisions for mounting a wiring device directly to the box.
 - g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
 - i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 - j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 - k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 - m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 - n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - o. Raised-Floor Box: A floor box intended for use in raised floors.
 - p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 - q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 - r. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - t. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
- 10. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
 - 11. Essential Electrical Systems: (healthcare facilities) Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.
 - 12. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.
 - a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 power-limited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical power sources.
 - 13. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
 - 14. Jacket: A continuous nonmetallic outer covering for conductors or cables.

15. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
16. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
17. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
18. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
19. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
20. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
21. Sheath: A continuous metallic covering for conductors or cables.
22. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
23. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
 - e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
 - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.
24. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
 1. Notify Architect and Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Architect's and Construction Manager's written permission.
 3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
 - a. Exercising generators.
 - b. Emergency lighting.
 - c. Elevators.
 - d. Fire-alarm systems.
- B. Arrange to provide temporary electrical power in accordance with requirements specified in Division 01.

1.4 PREINSTALLATION MEETINGS

- A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:
 1. Electrical installation schedule.
 2. Status of power system studies.
 3. Value analysis proposals and requests for substitution of electrical equipment.

1.5 SEQUENCING

- A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.6 ACTION SUBMITTALS

- A. Coordination drawings.

1.7 INFORMATIONAL SUBMITTALS

- A. Electrical installation schedule.
- B. Qualification statements.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.9 QUALITY ASSURANCE

- A. Qualifications: Prepare and submit qualification statements for the following entities performing Work on Project:
 - 1. Electrical Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in electrical engineering, including electrical power system modeling and analysis of electrical safety in accordance with NFPA 70E.
 - 2. Low-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - a. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.
 - 3. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under the NVLAP for Energy Efficient Lighting Products, and complying with applicable IES testing standards.
 - 4. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with IES LM-5.

1.10 FIELD CONDITIONS

- A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 26 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:
 - 1. Notification of Contractor's intent to request substitutions for convenience must be declared during the Electrical Preconstruction Conference so potential risks to system performance and construction schedule may be identified for Contractor's response in submission of the substitution request. Submission of requests for substitutions for convenience must meet the conditions and deadline specified in Section 012500 "Substitution Procedures" to receive approval.
 - 2. For electrical equipment and systems, substitutions for cause are considered major construction risks. If it is possible that Contractor may need to request substitutions for cause because of equipment unavailability, or inability to meet construction schedule because of lead time, Contractor must declare the possibility during the Electrical Preconstruction Conference to permit establishing a mitigation plan for minimizing risks to system performance and construction schedule.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
 - 1. Submission of specified coordination drawings.
 - 2. Submission of action submittals specified in Division 26.
 - 3. Preinstallation meetings specified in Division 26.
 - 4. Closing of walls and ceilings containing electrical Work.
 - 5. System startup, testing, and commissioning activities for emergency lighting.
 - 6. Requests for inspections by authorities having jurisdiction.

3.2 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.3 FIELD QUALITY CONTROL

- A. Adminstrant for Low-Voltage Electrical Tests and Inspections:
 - 1. Administer and perform tests and inspections.
- B. Adminstrant for Field Tests and Inspections of Lighting Installations:
 - 1. Administer and perform tests and inspections.

3.4 CLOSEOUT ACTIVITIES

- A. Operation and Maintenance Data: Prepare and submit the following:
 - 1. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. Schedule of maintenance material items recommended to be stored at Project site.
 - c. Detailed instructions covering operation under both normal and abnormal conditions.
- B. Demonstration: Demonstrate to Owner's maintenance and clerical personnel how to operate the following systems and equipment:
 - 1. Lighting control devices specified in Section 260923 "Lighting Control Devices."
- C. Training: Train Owner's maintenance personnel on the following topics:
 - 1. How to adjust, operate, and maintain devices specified in Section 260923 "Lighting Control Devices."

END OF SECTION

SECTION 260011

FACILITY PERFORMANCE REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Field conditions and other facility performance requirements applicable to Work specified in Division 26.

1.2 FIELD CONDITIONS

- A. Altitude:
 - 1. Sea level to 1000 ft..
- B. Ambient Temperature:
 - 1. 110 degrees Fahrenheit.
- C. Temperature Variation: Allow for thermal movements from the following differential temperatures:
 - 1. Ambient Temperature Differential: 120 deg F.
 - 2. Material Surface Temperature Differential: 180 deg F.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copper building wire.
 - 2. Metal-clad cable, Type MC.
 - 3. Fire-alarm wire and cable.
 - 4. Connectors and splices.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. 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. Belden Inc.
 - 2. Encore Wire Corporation.
 - 3. Okonite Company (The).
 - 4. Southwire Company, LLC.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type NM. Comply with UL 83 and UL 719.
 - 2. Type THHN. Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. 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. Belden Inc.
 2. Encore Wire Corporation.
 3. Okonite Company (The).
 4. Southwire Company, LLC.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 2. Comply with UL 1569.
 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
1. Single circuit.
 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
1. Type TFN/THHN/THWN-2. Comply with UL 83.
 2. Type XHHW-2. Comply with UL 44.
- H. Armor: Steel, interlocked.
- I. Jacket: PVC applied over armor.

2.3 FIRE-ALARM WIRE AND CABLE

- 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. Allied Wire & Cable Inc.
 2. Genesis; Resideo Technologies, Inc.
 3. Superior Essex Inc.; subsidiary of LS Corp.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. 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. ABB, Electrification Business.
 2. Hubbell Utility Solutions; Hubbell Incorporated.
 3. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 4. Service Wire Co.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One hole with standard barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Branch Circuits:
 - 1. Copper:
 - a. Solid for No. 8 AWG and smaller; stranded for No. 6 AWG and larger.
- B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

- A. Comply with NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 280528 "Pathways for Electronic Safety and Security."
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.
 - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
 - 3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is not permitted.
 - 4. Signaling Line Circuits: Power-limited fire-alarm cables may be installed in the same cable or pathway as signaling line circuits.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one

color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

- F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1 inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.
- D. Comply with requirements in Section 284621.13 "Conventional Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

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

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Grounding and bonding conductors.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

- A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.
- B. PBB: Primary bonding busbar, located in main distribution frame room, ideally near electrical service entrance.
- C. RBB: Rack bonding busbar, located in equipment cabinets and racks.
- D. SBB: Secondary bonding busbar, located in intermediate distribution frame rooms.
- E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.
- F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.
- G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.
- H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Grounding and bonding conductors.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. UL KDSH - Protector Grounding Conductor:
 - 1. Description: Conductors intended to be used for grounding primary protector or metallic members of cable sheath in accordance with Chapters 7 and 8 of NFPA 70.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Superior Essex Inc.; subsidiary of LS Corp.
 - 3. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 4. Listing Criteria:
 - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
 - 5. Options:
 - a. Color: green.

PART 3 - EXECUTION

3.1 SELECTION OF GROUNDING AND BONDING PRODUCTS FOR ELECTRICAL POWER

- A. Grounding and Bonding Conductors:
 - 1. Provide solid conductor for 10 AWG and smaller.
 - 2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
 - 3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.

3.2 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING OF ELECTRICAL POWER

- A. Field tests and inspections must be witnessed by JPS Project Manager.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
- C. Nonconforming Work:
 - 1. Grounding system will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective components and retest.
- D. Collect, assemble, and submit test and inspection reports.
 - 1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω .

3.3 FIELD QUALITY CONTROL FOR BONDING OF COMMUNICATIONS

- A. Field tests and inspections must be witnessed by JPS project manager>.
- B. Nonconforming Work:
 - 1. Communications bonding will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- C. Collect, assemble, and submit test and inspection reports.

3.4 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Support, anchorage, and attachment components.
 - 2. Fabricated metal equipment support assemblies.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
 - 1. Hangers. Include product data for components.
 - 2. Slotted support systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
 - 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. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. CADDY; brand of nVent Electrical plc.
 - d. Cooper B-line; brand of Eaton, Electrical Sector.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Plain steel.
 - 4. Channel Width: Selected for applicable load criteria .
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel for interior applications and cold cut galvanized steel with painted ends for exterior applications, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 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) Cooper B-line; brand of Eaton, Electrical Sector.
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 4) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
 5. Toggle Bolts:
 - a. Interior: All steel springhead type.
 6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

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

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA NEIS 101
- B. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."
- C. Comply with requirements for boxes specified in Section 260533.16 "Boxes and Covers for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by NFPA 70. Minimum rod size must be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 200 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Existing Concrete: Expansion anchor fasteners.
 2. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 3. To Light Steel: Sheet metal screws.
 4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing

bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION

SECTION 260533.13

CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Type EMT-S raceways and elbows.
 - 2. Fittings for conduit, tubing, and cable.
 - 3. Electrically conductive corrosion-resistant compounds for threaded conduit.
- B. Products Installed, but Not Furnished, under This Section:
 - 1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.
- C. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
 - 3. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

1.2 DEFINITIONS

- A. Conduit: A structure containing one or more duct raceways.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Type EMT-S raceways and elbows.
 - 2. Fittings for conduit, tubing, and cable.
 - 3. Electrically conductive corrosion-resistant compounds for threaded conduit.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions:
 - 1. Type EMT-S raceways and elbows.
 - 2. Fittings for conduit, tubing, and cable.
 - 3. Electrically conductive corrosion-resistant compounds for threaded conduit.

PART 2 - PRODUCTS

2.1 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN FJMX; including UL 797.
- B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
 - 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. Allied Tube & Conduit; Atkore International.

- b. Emerson Electric Co., Automation Solutions.
 - c. Western Tube; Zekelman Industries.
 - d. Wheatland Tube; Zekelman Industries.
- 2. Material: Steel.
- 3. Options:
 - a. Interior Coating: Zinc.
 - b. Minimum Trade Size: Metric designator 21 (trade size 3/4).

2.2 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL FKA V - Fittings for Type EMT Raceways:
 - 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. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Southwire Company, LLC.
 - 2. Listing Criteria: UL CCN FKA V; including UL 514B.
 - 3. Options:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling.
 - c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

2.3 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN FOIZ; including UL Subject 2419.
- B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL FOIZ - Electrically Conductive Corrosion-Resistant Compound for Threaded Conduit:
 - 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. ABB, Electrification Business.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Indoors:
 - 1. Exposed and Not Subject to Physical Damage: EMT.
 - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
 - 2. Consult Architect for resolution of conflicting requirements.

END OF SECTION

SECTION 260533.16

BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nonmetallic outlet boxes, device boxes, rings, and covers.
 - 2. Junction boxes and pull boxes.
 - 3. Cover plates for device boxes.
- B. Products Installed, but Not Furnished, under This Section:
 - 1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.
- C. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Nonmetallic outlet boxes, device boxes, rings, and covers.
 - 2. Junction boxes and pull boxes.
 - 3. Cover plates for device boxes.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions:
 - 1. Nonmetallic outlet boxes, device boxes, rings, and covers.
 - 2. Junction boxes and pull boxes.
 - 3. Cover plates for device boxes.

PART 2 - PRODUCTS

2.1 NONMETALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. Listing Criteria: UL CCN QCMZ; including UL 514C.
- B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL QCMZ - Nonmetallic Outlet Boxes and Covers:
 - 1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - d. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - e. Ericson Manufacturing Company.

- f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - h. Leviton Manufacturing Co., Inc.
 - i. Pass & Seymour; Legrand North America, LLC.
 - j. Wiremold; Legrand North America, LLC.
 - D. UL QCMZ - Nonmetallic Conduit Bodies:
 - 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Cantex Inc.
 - E. UL QCMZ - Nonmetallic Device Boxes:
 - 1. Description: Box with provisions for mounting wiring device directly to box.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ABB, Electrification Business.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - e. Pass & Seymour; Legrand North America, LLC.
- 2.2 JUNCTION BOXES AND PULL BOXES
- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.
 - B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
 - C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Cooper B-line; brand of Eaton, Electrical Sector.
 - b. Hoffman; brand of nVent Electrical plc.
 - c. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Square D; Schneider Electric USA.
 - 3. Options:
 - a. Degree of Protection: Type 1.
 - D. UL BGUZ - Indoor Cast-Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - b. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - 3. Options:
 - a. Degree of Protection: Type 1.

2.3 COVER PLATES FOR DEVICES BOXES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
 - 3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- B. Source Quality Control:
 - 1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
 - 2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
- C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:
 - 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. ABB, Electrification Business.
 - b. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - c. Crouse-Hinds; brand of Eaton, Electrical Sector.
 - d. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - e. Leviton Manufacturing Co., Inc.
 - f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
 - g. Pass & Seymour; Legrand North America, LLC.
 - h. Wiremold; Legrand North America, LLC.
 - 2. Options:
 - a. Wallplate Material: As indicated on architectural Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Shop Drawings: Prepare and submit the following:

3.2 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

3.3 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
 - 2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - 3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
 - 4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - 5. Locate boxes so that cover or plate will not span different building finishes.
 - 6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
 - 7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
10. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
11. Identification: Provide labels for boxes and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Label each box with engraved metal or laminated-plastic nameplate.

3.4 PROTECTION

- A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Extruded insulating tubing.
 - 3. Bands.
 - 4. Tapes and stencils.
 - 5. Cable ties.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

- A. Product data.

PART 2 - PRODUCTS

2.1 LABELS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.
- B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
 - 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. Brady Corporation.
 - b. Champion America.
 - c. Panduit Corp.
- C. UL PGDQ2 - Self-Adhesive Wraparound Labels: Preprinted or Write-on, 3 mil thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 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. Brady Corporation.
 - b. Brother International Corporation.
 - c. Panduit Corp.
 - 2. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
 - 3. Marker for Labels:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. UL PGDQ2 - Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3 mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 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. Brady Corporation.
 - b. Brother International Corporation.

- c. Panduit Corp.

2.2 EXTRUDED INSULATING TUBING

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN YDPU2 for components; including UL 224.
- B. UL YDPU2 - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F.
 - 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. Brady Corporation.
 - b. Panduit Corp.

2.3 BANDS

- A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
 - 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. Brady Corporation.
 - b. Panduit Corp.
- B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch long, with diameters sized to suit diameters and that stay in place by gripping action.
 - 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. Brady Corporation.
 - b. Panduit Corp.

2.4 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
 - 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. Brady Corporation.
 - b. Champion America.
 - c. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil thick by 1 to 2 inch wide; compounded for outdoor use.
 - 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. Brady Corporation.
 - b. Marking Services Inc.

2.5 CABLE TIES

- 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. Marking Services Inc.
 - 2. Panduit Corp.
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.
- C. UL ZODZ - General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and

Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- D. UL ZODZ - Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F in accordance with ASTM D638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

- A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:
1. Fire-protection and fire-alarm , including raceways, must be finished, painted, or suitably marked safety red.
 2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than 7.7 ft above finished floor.
- B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded \ branch-circuit conductors.
1. Color must be factory applied.
 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 3. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 4. Color for Neutral (Grounded Conductor): gray.
 5. Color for Equipment Ground: Green with yellow stripe.
- C. Color-Coding Raceways, Cable Trays, Junction Boxes, and Conductors for Intrinsically-Safe Circuits: Light blue. When used to identify intrinsically-safe circuits, Article 504 of NFPA 70 requires that the color light blue not be used for any other purpose.
- D. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
1. "POWER."
 2. "COMMUNICATIONS."
- E. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- F. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels or vinyl tape applied in bands.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft maximum intervals in straight runs, and at 25 ft maximum intervals in congested areas.
 2. Identify system voltage and system or service type with black letters on orange field .
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-

adhesive labels with conductor designation.

- I. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate to be labeled with its individual, sequential designation, composed of the following, in the order listed:
 - 1. Wiring closet designation.
 - 2. Color.
 - 3. Faceplate number.

3.3 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.
- G. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- J. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- K. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- L. Self-Adhesive Labels:
 - 1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch high letters on 1-1/2 inch high label; where two lines of text are required, use labels 2 inch high.
- M. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- N. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- O. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- P. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION

SECTION 26 0800

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The purpose of this section is to specify the Division 26 responsibilities and participation in the Commissioning Process.
- B. Work under this contract shall conform to requirements of Division 01, General Requirements, Conditions of the Contract, and Supplementary Conditions. This specification covers commissioning of mechanical systems which are part of this project.
- C. Commissioning work shall be a team effort to ensure that all electrical equipment and systems have been completely and properly installed, function together correctly to meet the design intent, and document system performance. Commissioning shall coordinate system documentation, equipment start-up, control system calibration, testing and balancing, and verification and performance testing.
- D. The Commissioning Team shall be made up of representatives from the owner, Design Team, General Contractor (GC), manufacturers, and construction trades. The trades represented on the Commissioning Team shall include, but not be limited to: sheet metal, piping and fitting, controls, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the Commissioning Team. Responsibility for various steps of the Commissioning Process shall be divided among the members of the Commissioning Team, as described in this section.
- E. The CxA (Commissioning Authority) shall have responsibility for coordinating and directing each step of the Commissioning Process.
- F. Electrical system installation, start-up, testing, balancing, preparation of O&M manuals, and operator training are the responsibility of the Division 26 Contractors, with coordination, observation, verification and commissioning the responsibility of Division 01. The Division 01 Commissioning Process does not relieve Division 26 from the obligations to complete all portions of work in a satisfactory and fully operational manner.

1.2 Electrical Contractor (EC) and Electrical Sub-Contractors:

- A. Provide all personnel, tools, materials, and equipment to support the commissioning process. Facilitate the coordination of the commissioning work by the CxP (Commissioning Providers) and incorporate commissioning activities into the master schedule.
- B. Incorporate all commissioning related activities into the project schedule, ensuring that Cx (Commissioning) activities do not delay project completion.
- C. Notify JPS and the CxP in writing that equipment and systems are ready for functional testing.
- D. Perform equipment startups using authorized manufacturing representatives.
- E. Provide written documentation to the CxP that equipment and systems are fully operational and ready to be functionally performance tested.
- F. Perform commissioning tests at the direction of the CxP, including change of season testing.
- G. Attend construction phase commissioning coordination meetings.
- H. Provide qualified personnel for participation in commissioning tests.
- I. Provide equipment, materials, and labor necessary to correct deficiencies found during the commissioning process.
- J. Participate in electrical systems, assemblies, equipment, and component maintenance orientations and inspections as directed by the CxP.
- K. Provide information requested by the CxP for commissioning documentation and testing.
- L. Perform all quality control functions to ensure equipment and systems are installed properly. Ensure equipment and systems are brought to a state of readiness and full functionality prior to commencing the commissioning functional performance testing processes.

- M. Provide qualified personnel for participation in Commissioning tests.
- N. Provide a representative to attend end of warranty testing.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION – (Not Used)

END OF SECTION

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Indoor occupancy and vacancy sensors.
 - 2. Switchbox-mounted occupancy sensors.
 - 3. Conductors and cables.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
 - 3. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Match existing controls manufacturer.
- B. General Requirements for Sensors:
 - 1. Ceiling-mounted, solid-state indoor occupancy sensors.
 - 2. Dual technology.
 - 3. Hardwired connection to switch.
 - 4. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 5. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 6. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
 - 7. Power: Line voltage.
 - 8. Power Pack: Dry contacts rated for 20 A LED load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
 - 9. Mounting:
 - a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
 - b. Relay: Externally mounted through a 1/2 inch knockout in a standard electrical enclosure.

- c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - 10. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 - 11. Bypass Switch: Override the "on" function in case of sensor failure.
 - 12. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
 - C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6 inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch, and detect a person of average size and weight moving not less than 12 inch in either a horizontal or a vertical manner at an approximate speed of 12 inch/s.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96 inch high ceiling.
 - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 sq. ft. when mounted 48 inch above finished floor.
- 2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS
- A. Match existing controls manufacturer.
 - B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.
 - 1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
 - 4. Switch Rating: Not less than 800 VA LED load at 120 V, 1200 VA LED load at 277 V, and 800 W incandescent.
- 2.3 CONDUCTORS AND CABLES
- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION OF SENSORS

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

3.2 INSTALLATION OF CONTACTORS

3.3 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by JPS project manager.
- B. Tests and Inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Nonconforming Work:
 - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 262719

MULTI-OUTLET ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Indoor service poles.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
 - 3. Section 260533.13 "Conduits for Electrical Systems" and Section 260533.23 "Surface Raceways for Electrical Systems" for raceways.
 - 4. Section 260533.16 "Boxes and Covers for Electrical Systems" for floor boxes and covers.
 - 5. Section 262726 "Wiring Devices" for receptacles and switches.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Indoor service poles.

PART 2 - PRODUCTS

2.1 INDOOR SERVICE POLES

- A. Description: Factory-assembled and -wired, exposed raceway and fittings to route electrical wiring from connections above ceiling to outlets below ceiling.
- B. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
- C. General Characteristics:
 - 1. Reference Standards: UL 5 for exposed power raceway and fittings, and UL 2024 for communications raceway and fittings.
 - 2. Listed and labeled in accordance with NFPA 90A for installation in air-handling plenum spaces.
 - 3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to above ceiling structural supports; with pole foot and carpet pad attachment.
 - 4. Provide barrier to separate channel for power wiring from channel for voice and data communication cabling.
- D. Indoor Service Pole :
 - 1. Provide products by one of the following:
 - a. Hubbell
 - b. Legrand
 - 2. Options:
 - a. Material: Steel.
 - b. Height: Affix to floor and extend above ceiling.
 - c. Finish: Manufacturer's standard painted finish and trim combination.
 - 1) Color: White .
 - d. Power Outlets: As noted on drawings in accordance with Section 262726 "Wiring Devices."
 - e. Wiring: Single circuit in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - f. Voice and Data Communication Outlets: blank insert with bushed cable opening complying with requirements in Section 271500 "Communications Horizontal Cabling."
 - g. A minimum of two four-pair cables in accordance with Section 271513 "Communications Copper Horizontal Cabling" for each outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 101 for installation requirements for steel raceways, except where requirements on Drawings or in this Section are stricter.
- B. Comply with NECA 102 for installation requirements for aluminum raceways, except where requirements on Drawings or in this Section are stricter.
- C. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies.
- D. Provide terminations, adapters, boxes, and other fittings required for installation.
- E. Do not install aluminum raceways or fittings in contact with concrete.
- F. Coordination with Other Work:
 - 1. Adjust locations of multi-outlet assemblies to suit arrangement of partitions and furnishings. Locate outlets to avoid blocking by supports, furnishings, and other architectural fixtures.
 - 2. Provide outlets with special requirements, such as GFCI, AFCI, or special environmental requirements, where required by Drawings or to meet codes.

3.2 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hospital-grade duplex straight-blade receptacles.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
 - 3. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.
 - 4. Section 262726.11 "General-Use Switches, Dimmer Switches, and Fan-Speed Controller Switches" for additional wiring device products.
 - 5. Section 262726.33 "General-Grade Duplex Straight-Blade Receptacles" for additional wiring device products.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Preinstallation Coordination Meeting(s): For ceiling-mounted cable reels. Conduct meeting as videoconference or at Project site before rough in.
 - 1. Attendees: Installers, fabricators, representatives of manufacturers, and administrators for field tests and inspections. Notify Architect, Construction Manager JPS project manager of scheduled meeting dates.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Hospital-grade straight-blade receptacles.
- B. Samples:
 - 1. One for each kind of hospital-grade straight-blade receptacle and cover plate accessory specified, in each finish and color specified.
- C. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
 - 1. Hospital-grade straight-blade receptacles.
- B. Sample warranties.

PART 2 - PRODUCTS

2.1 HOSPITAL-GRADE STRAIGHT-BLADE RECEPTACLES

- A. Hospital-Grade, Non-Ferrous Duplex Straight-Blade Receptacle:
 - 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. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - 2. Regulatory Requirements:

- a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- 3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
- 4. Options:
 - a. Device Color: Match existing.
 - b. Configuration: Extra-heavy-duty, NEMA 5-20R.
- 5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.
- B. Hospital-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle :
 - 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. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - 2. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 3. General Characteristics:
 - a. Reference Standards: UL CCN RTRT and UL 498.
 - 4. Options:
 - a. Device Color: Match existing.
 - b. Configuration:
 - 1) Heavy-duty, NEMA 5-20R.
 - 5. Accessories:
 - a. Cover Plate: 0.060 inch thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
 - b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

2.2 CONNECTORS, CORDS, AND PLUGS

- A. Outdoor-Use, Watertight, Sealed Cord Connector
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. General Characteristics:
 - a. Reference Standards: UL CCN AXUT and UL 498.
 - b. Material: die-cast.
 - 3. Options:
 - a. Configuration:
 - 1) NEMA 5-20.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receptacles:
 - 1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

3.2 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

- A. Comply with manufacturer's instructions.
- B. Reference Standards:
 - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
 - 2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting

- heights recommended in NECA NEIS 1.
 - 3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
 - a. Hospital-Grade Receptacle Orientation: Orient receptacle with ground pin or neutral pin at top.
 - 4. Consult Architect for resolution of conflicting requirements.
 - C. Identification:
 - 1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."
- 3.3 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES
- A. Field tests and inspections must be witnessed by JPS project manager.
 - B. Tests and Inspections:
 - 1. Insert and remove test plug to verify that device is securely mounted.
 - 2. Verify polarity of hot and neutral pins.
 - 3. Measure line voltage.
 - 4. Measure percent voltage drop.
 - 5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
 - 6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.
 - C. Nonconforming Work:
 - 1. Device will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
 - D. Assemble and submit test and inspection reports.
- 3.4 PROTECTION
- A. Devices:
 - 1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
 - 2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 265000

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luminaires.
 - 2. Luminaire fittings.
 - 3. Lamps.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260011 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
 - 3. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" specifies wiring connections installed by this Section.
 - 4. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
 - 5. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For luminaires.
 - a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - b. Product Certificates: Include product certificates stating compliance with standards listed below, signed by manufacturer or fabricator.
 - 1) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 - 2) Testing Agency Certified Data: For luminaires indicated on Lighting Fixture Schedule on Drawings, photometric data certified by qualified independent testing laboratory. Photometric data for remaining luminaires must be certified by manufacturer.
 - c. Include battery and charger data for emergency lighting units.
 - d. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - e. Include manufacturer's sample warranty language.
 - 2. For luminaire fittings.
 - a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - b. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
 - c. Include manufacturer's sample warranty language.
- B. Shop drawings.
- C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturers' published instructions.
- B. Field Reports:
 - 1. Manufacturer's field reports for field quality-control support.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Performance Criteria:
1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - b. See individual product types below for listing criteria.
 - c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
- B. Source Quality Control:
1. Compile and submit product data.
 2. Compile and submit sustainable design product data.
 3. Compile and submit samples.
- C. Luminaire :
1. Product Listing Criteria, LED: UL CCN IFAM; including UL 1598.
 2. Product Listing Criteria, Outdoor Canopy Luminaires: UL CCN IFAW; including UL 1598.
 3. Product Characteristics:
 - a. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit relamping without use of tools or parts falling from enclosure.
 - b. Nominal Operating Voltage: 277 V(ac) .
 - c. Nominal Luminaire Operating Power Rating: Refer to light fixture schedule.
 - d. CRI: 80
 - e. Driver Location: Internal unless otherwise noted.
 - f. Materials:
 - 1) Enclosure: Refer to light fixture schedule ; free of sharp edges and burrs.
 - 2) Enclosure Ingress Protection Rating: Refer to light fixture schedule.
 - 3) Lenses, Diffusers, and Globes: Refer to light fixture schedule
 - a) Lens Thickness: Not less than 0.125 inch unless otherwise indicated.
 - b) Distribution: Refer to light fixture schedule.
 - 4) Visible variations in metal finishes are unacceptable in adjoining components.
 - g. LED Luminaires (UL CCN IFAM):
 - 1) Output Intensity: Refer to light fixture schedule.
 - 2) Rated Life: 50 000 hours to L70.
 - 3) CCT: selectable 3500-5000 K .
- D. UL FTBR or FTBV - Emergency Lighting and Power Equipment :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - b. Emergi Lite
 - c. Ioslite
 2. Product Listing Criteria: UL CCN FTBR or UL CCN FTBV; including UL 924, NFPA 101, and ICC IBC.
 3. Product Characteristics:
 - a. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - b. Status and Test Indication: Visible and accessible without opening luminaire or entering ceiling space.
 - 1) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 2) Test Push-Button: Push-to-test button in unit housing simulates loss of normal power

- and demonstrates unit operability.
 - c. Nominal Operating Voltage: 277 V(ac).
 - d. Mounting: with universal junction box adaptor.
 - e. Enclosure: UV stable thermoplastic housing rated for damp locations.
 - f. Flame Rating: UL 94
 - g. Light Source: LED heads.
 - 4. Required Product Options:
 - a. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
 - Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a) Push-Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 2) Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - 5. Installation Markings:
 - a. Relamping Labels: Include recommended lamp type, diameter, shape, size, wattage, and coating on factory-applied label that is visible when luminaire is open for relamping.
 - b. All Luminaires (UL CCN HYXT):
 - 1) Marked to identify voltage supply or type of branch circuit or both.
- E. UL FWBO - Exit Fixture :
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lithonia Lighting; Acuity Brands Lighting, Inc.
 - b. Emergi Lite
 - c. Ioslite
 - 2. Product Listing Criteria: UL CCN FWBO; including UL 924, NFPA 101, and ICC IBC.
 - 3. Product Characteristics:
 - a. Nominal Operating Voltage: 277 V(ac).
 - b. Light Source: LED; 50,000 hours minimum rated life.
 - c. Legend Color: Red.
 - d. Internal emergency power unit.
 - e. Master/Remote Sign Configurations:
 - 1) Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in battery for power connection to remote unit.
 - 2) Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.
 - 4. Required Product Options:
 - 5. Installation Markings:
 - a. All Luminaires (UL CCN HYXT):
 - b. T):
 - 1) Marked to identify voltage supply or type of branch circuit or both.
 - c. Exit Fixtures (UL CCN FWBO):

2.2 LUMINAIRE FITTINGS

- A. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - b. See individual product types below for listing criteria.
- B. Source Quality Control:
 - 1. Compile and submit product data.
 - 2. Compile and submit sustainable design product data.
 - 3. Compile and submit samples.

- C. Luminaire Support Accessories:
 - 1. Product Characteristics:
 - a. Sized and rated for luminaire weight.
 - b. Capable of maintaining luminaire position after cleaning and relamping.
 - c. Capable of supporting luminaire without causing deflection of ceiling or wall.
 - d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.

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 luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Shop Drawings: Prepare and submit the following:
 - 1. Drawings, Diagrams, and Supporting Documents for Custom Luminaires:
 - a. Include plans, elevations, sections, and mounting and attachment details.
 - b. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - c. Include diagrams for power, signal, and control wiring.
- B. Temporary Lighting: If approved by Architect, specified luminaires for Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for Project delivery.

3.3 SELECTION OF LIGHTING

3.4 INSTALLATION OF LIGHTING

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
 - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Installation Techniques:
 - 1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
 - 2. Coordinate layout and installation of luminaires with other construction.
 - 3. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
 - 4. Flush-Mounted Luminaire Support:
 - a. Secured to outlet box.
 - b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - c. Trim ring flush with finished surface.
 - 5. Wall-Mounted Luminaire Support:
 - a. Attached to structural members in walls.
 - b. Do not attach luminaires directly to gypsum board.
 - 6. Install wiring connections for luminaires.
 - 7. Identification: Provide labels for luminaires and associated electrical equipment.
 - a. Identify field-installed conductors, interconnecting wiring, and components.
 - b. Provide warning signs.
 - c. Label each enclosure with engraved metal or laminated-plastic nameplate.

- D. Interfaces with Other Work:
 - 1. Coordinate installation of new products with existing conditions.
- E. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.5 FIELD QUALITY CONTROL OF LIGHTING

- A. Field tests and inspections must be witnessed by JPS project manager.
- B. Tests and Inspections:
 - 1. Perform manufacturer's recommended tests and inspections.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
 - 4. Verify operation of photoelectric controls.
- C. Nonconforming Work:
 - 1. Luminaire will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective units and retest.
- D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.
- E. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.
 - 1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.6 PROTECTION

- A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 283111

DIGITAL ADDRESSABLE FIRE-ALARM SYSTEM AND VOICE EVACUATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section of the specification includes the extension of an existing system including furnishing, installation, connection, and testing of the intelligent, microprocessor controlled, analog addressable, fire to form a complete and operational system. It shall include but not be limited to alarm notification appliances..
- B. The fire alarm system shall comply with the requirements of NFPA 72 National Fire Alarm Code except as modified by the local Authority Having Jurisdiction and supplemented by this specification. The system field devices shall be supervised either electrically or through software driven polling process.
- C. The FACP and associated field devices shall be manufactured or supplied 100% by a single U.S. manufacturer that is ISO 9001 certified.
- D. The FACP and associated field devices system shall comply with the following Underwriters Laboratories Inc. (UL) USA listing standards as applicable.
 - 1. No. 268 Smoke Detectors for Fire Protective Signaling Systems
 - 2. No. 464 Audible Signaling Appliances
 - 3. No. 1971 Visual Notification Appliances
- E. The installing company shall provide employ NICET Level II (or higher) fire alarm technicians to supervise the programming and testing of the system and to ensure the systems integrity.

1.2 SCOPE:

- A. An intelligent, microprocessor controlled, analog addressable fire alarm detection system shall be installed in accordance with the project specifications and drawings.
- B. Basic Performance:
 - 1. Analog Addressable devices shall be connected to the FACP Signaling Line Circuit (SLC)
 - 2. The SLC loop shall not require twisted or shielded cabling. Systems that require twisted and/or shielded cabling for the SLC loop are not acceptable.
 - 3. All circuits shall be power limited per UL 864 requirements.
- C. Basic System Operation
 - 1. When an off normal condition occurs (Alarm, Supervisory, or Trouble) the respective LED on the FACP shall illuminate.
 - 2. A piezo sounder shall activate at the FACP during any off normal condition until the SILENCE button is pressed by an authorized user.
 - 3. A Red LED shall illuminate when an alarm or pre-alarm condition exists.
 - 4. An Amber (yellow) LED shall illuminate when a Supervisory or Trouble condition exists.
 - 5. An Alarm condition shall have priority over all other signals.
 - 6. When mandated by AHJ, system shall be capable of being configured to allow ECS/MNS activated messages.
 - 7. In response to a fire alarm condition, the systems notification appliances and relay controlled output circuits that are associated through programming with the device initiating the alarm, shall automatically activate. Additionally, the system shall notify an approved central station via dial-up, IP, or cellular means as deemed acceptable by the local Authority Having Jurisdiction (AHJ).

1.3 SUBMITTALS:

- A. General
 - 1. Two (2) copies of all submittals shall be submitted to the Architect/Engineer for review and approval.
 - 2. All references to manufacturers model numbers and other pertinent information herein is intended to establish minimum standards of performance, function, and quality.
 - 3. For equipment other than that specified, the contractor shall provide proof that the proposed substitute equipment equals or exceeds the form, feature, function, performance, and quality of the specified equipment.

B. Shop Drawings

1. Drawings shall be provided that include all field devices that are installed as part of the fire alarm system including the address, circuit, location, and type for each. Whenever possible, the drawings shall reflect other components of the building such as air diffusers, HVAC returns, lights, etc. to determine compliance.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72 including sound-pressure levels for audible appliances.
3. Drawings shall include footcandle (fc) rating for all strobes.
4. The drawings shall include conductor counts and wire sizes for each circuit.
5. The location and mounting configuration of the FACP, remote power supplies, and terminal cabinets shall be indicated on the drawings.
6. Indicate all speakers on floor plans required to comply with IFC 2012 intelligibility requirements and verify that layout will provide the required sound power over predicted ambient noise.

C. Other documentation

1. In addition to the shop drawings, the following information shall also be included with the submittal.
2. Manufacturer's technical data sheets for each piece of equipment that will be installed.
3. Standby battery calculations for the FACP and any remote power supply or other panels that include their own standby batteries.
4. Voltage drop calculations showing the worst case end of line voltage for all notification appliance circuits.
5. Detailed description of the overall operation of the system or a sequence of operation matrix.
6. Proof of factory training and certification of the supervising technician assigned to the project.
7. Proof of factory training and certification of a service technician employed by the installation company that can be onsite to troubleshoot and repair any service-related problems with the system, within 4 hours of being notified of the problem.
8. NICET certifications for installer supervisor and designer.
9. Manufacturer certification for installer and designer.
10. State license for the fire alarm contractor.

1.4 WARRANTY:

- A. All of the main fire alarm system components including control panels, detectors, modules, and notification devices furnished under this contract shall include a warranty from the manufacturer for a period of five (5) years from the date of purchase. All other materials, labor and work performed under this contract shall be free of defects and shall remain so for a period of one (1) year from the date of acceptance. The full cost of materials and labor to correct any defects during these warranty periods shall be included in the installed price of the system.

1.5 MAINTENANCE:

- A. Maintenance and testing shall be on a semi-annual basis or as required by the AHJ. A preventative maintenance schedule shall be provided by the contractor describing the protocol for preventative maintenance. The schedule shall include:
1. Systematic testing and complete inspection of the entire fire alarm system including control panels, field devices, and wiring terminations including smoke sensors, manual pull stations, sprinkler system switches, remote panels, power supplies, and terminal boxes, and all other fire alarm accessories, in accordance with NFPA 72. Cleaning and adjusting of these devices shall be conducted at this time.
 2. An inspection and test of system power supplies, batteries, circuit breakers, and fuses as well as a load test of the batteries shall be conducted in accordance with NFPA 72.
 3. Placing the system into an alarm condition and checking each notification device for proper operation.
 4. Removing devices from the FACP SLC circuit to ensure a trouble condition occurs.
 5. Input and output mapping shall be tested to ensure proper sequence of operation.
 6. Signal transmission shall be tested to the Monitoring Station.
 7. A report showing the calibrated sensitivity of each of the systems smoke detectors shall be generated from the fire alarm control panel and verified to ensure all smoke detectors are within UL tolerance.
 8. Following each periodic maintenance and test, the owner shall be provided with a detailed report of the test results including any deficiencies found.

1.6 POST CONTRACT EXPANSIONS:

- A. The contractor shall supply any necessary parts and/or labor necessary for expansion of the system for a period of 1 year from the date of completion.

- B. Provide 10% attic stock for each device type.
- C. When submitting the fire alarm system bid package, the contractor shall provide a quote for the expansion of the system by 10%. The quote shall include all costs for a complete installation including labor and materials for 1/10th of the number of devices used in the original overall specification and installation. The pricing shall be itemized to show single lot individual pricing of each item.
- D. The prices quoted for system expansion will remain valid for 1 year from the date of completion.
- E. The system expansion pricing shall be all inclusive and include costs for programming or reprogramming the system as needed.
- F. Submittals that do not include a quote for expansion will be rejected.

1.7 APPLICABLE STANDARDS AND SPECIFICATIONS:

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
 - 1. National Fire Protections Association (NFPA)
 - a. No. 13 Sprinkler Systems
 - b. No. 70 National Electric Code (NEC)
 - c. No. 72 National Fire Alarm Code
 - d. No. 101 Life Safety Code
 - e. No. 92 Standard on Smoke Control
 - 2. Local and State Building Codes
 - 3. All requirements of the local Authority Having Jurisdiction (AHJ)

1.8 APPROVALS:

- A. The system shall have the proper listing and/or approval from the following recognized agencies:
 - 1. UL Underwriters Laboratories Inc.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS:

- A. All equipment and components shall be new, and of the manufacturers current model. The materials, appliances, equipment, and devices shall be tested and listed for its intended purpose by a recognized national listing testing laboratory.
- B. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations as indicated in the installation manuals and wiring diagrams for the system.
- C. All equipment attached to walls and ceiling shall be securely fastened. Ceiling mounted devices shall not be supported solely by suspended ceilings. A back box shall be used for mounting all equipment. A listed and compatible back box shall be used on all outdoor devices, or those devices installed in locations subject to moisture.
- D. All equipment shall be manufactured by an ISO 9001 certified company.
- E. All equipment shall be readily available through wholesale distribution outlets to licensed installation contractors that are independent of the systems manufacturer.

2.2 CONDUIT AND WIRE:

- A. Conduit:
 - 1. The conduit or raceway shall be installed in accordance with the National Electrical Code, state and local requirements.
 - 2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40% on the interior cross sectional area where three or more cables are contained within a signal conduit.
 - 3. All conduit and raceway shall be listed and/or approved by a recognized national testing laboratory.
 - 4. Conduit size shall be 3/4" minimum.
 - 5. Conduit may only enter the fire alarm control panel, power supply, annunciator, and other system cabinets through the pre-punched knockouts provided by the system manufacturer.
 - 6. Fire alarm cables must be separated from any Class 1 circuits, and shall not be placed in any conduit, junction box, or raceway containing Class 1 or light or power circuits.

7. With the exception of speaker and V-Link voice circuit wiring, 24-volt DC control, alarm, notification, and similar power-limited auxiliary functions, may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

B. Wire:

1. All fire alarm wiring shall be new and plenum rated cable.
2. Wiring shall be installed in accordance with local, state, and national codes and as recommended by the manufacturer of the fire alarm system.
3. All wire and cable shall be listed and/or approved by a recognized national testing laboratory for its intended purpose.
4. The Signaling Line Circuit (SLC) loop shall be installed with a minimum #18 AWG wire and shall allow the use of non-twisted and non-shielded solid or stranded wire. Systems that require twisted and/or shielded wiring are not acceptable.
5. Each smoke compartment to be wired independently from others.
6. Notification Appliance Circuits (NAC) shall be wired with not less than #16 AWG wire as required for proper end of line operating voltage.
7. Speaker Circuits shall be wired with not less than #16 AWG wire as required for proper end of line voltage and decibel output.
8. All field wiring shall be supervised for open circuits and earth ground faults.
9. The FACP RS-485 wiring bus shall be capable of operating system devices up to 6500 feet away from the main panel, without the use of additional power supplies, boosters, or signal amplifiers.
10. Both ends of cabling shall be labeled.

C. Terminal Boxes, Junction Boxes, and Cabinets

1. All terminal boxes, junction boxes, and accessory cabinets shall be listed for their intended purpose.
2. All boxes and cabinets shall be labeled.

2.3 SYSTEM COMPONENTS

A. Compatible FACP Accessories

1. Class A module
 - a. Potter Electric Signal model CA-6500
 - CA-6500 shall provide the means to allow the FACP's SLC, P-LINK, and NAC circuits to be wired in a Class A configuration.
2. Signaling Line Expansion Module
 - a. Potter Electric Signal model PAD100-SLCE
 - 1) Shall provide means of connecting and communicating to additional PAD SLC devices.
 - 2) The system shall support 127 Addressable devices per card
 - 3) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 4) The system shall support a total of 31 additional SLC loops.
 - b. Potter Electric Signal model SLCE-127
 - 1) Shall provide means of connecting and communicating with existing Nohmi protocol based devices.
 - 2) The system shall support 127 Addressable devices per card
 - 3) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 4) The system shall support a total of 31 additional SLC loops.
3. Intelligent Power Expanders
 - a. Potter Electric Signal model PSN-1000(e)
 - 1) PSN-1000(e) shall add 10 amps of power, 6 programmable NAC circuits, and 2 programmable Dry Contact Input circuits.
 - 2) The PSN-1000(e) shall be capable of Quadrasync strobe synchronization as described earlier in this specification.
 - 3) The system shall support a total of 31 PSN-1000(e) Intelligent Power Expanders.
4. Dual Channel Amplifiers
 - a. Potter Electric Signal Dual Channel DCA Series Amplifier Panels
 - 1) DCA Series amplifiers shall be available in 50-watt and 100-watt models
 - 2) DCA Series amplifiers shall be available in 25 volt speaker circuits
 - 3) DCA Series amplifiers shall allow for installation of 70V-1000 module for 70V speaker

- circuits.
- 4) DCA Series amplifiers shall allow for installation of BUA-1000 to provide back-up amplifier
- 5) The system shall support a total of 31 amplifiers.
- 5. Single Channel Amplifiers
 - a. Potter Electric Signal Single Channel SCA Series Amplifier Panels
 - 1) SCA Series amplifiers shall be available in 25-watt, 50-watt and 100-watt models.
 - 2) SCA Series amplifiers shall be available with 25 volt or 25/70-volt selectable speaker circuits.
 - 3) SCA Series amplifiers shall include 8 class A or 8 class B programmable speaker circuits
 - 4) The system shall support a total of 31 amplifiers
- 6. LED Driver
 - a. Potter Electric Signal model DRV-50
 - 1) Shall be used to connect up to 50 LEDs in a graphic display
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) The system shall support a total of 10 LED Drivers.
- 7. Fire Communication Bridge
 - a. Potter Electric Signal model FCB-1000
 - 1) Shall provide remote mounting of the FACP's Ethernet connection
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) May be installed in the stacker bracket or ordered with optional rack mount enclosure.
- 8. Fiber Interface Bridge
 - a. Potter Electric Signal model FIB-1000
 - 1) The system shall support a total of 31 Fiber cards
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) May be installed in the stacker bracket or ordered with optional rack mount enclosure.
- 9. Serial Parallel Gateway
 - a. Potter Electric Signal model SPG-1000
 - 1) The system shall support a total of 31 Serial / Parallel Printer modules.
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) May be installed in the stacker bracket or ordered with optional rack mount enclosure.
- 10. Relay Expander
 - a. Potter Electric Signal model RLY-5
 - 1) The system shall support a total of 31 Relay cards
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) Contacts Rated to 3.0A at 24VDC and 3.0A at 125VAC.
- 11. Initiating Device Expander model IDC-6
 - a. Potter Electric Signal model IDC-6
 - 1) The system shall support a total of 31 IDC-6 Initiating Device Expander
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) All six (6) Inputs capable of supporting 2-wire conventional smoke detectors.
- 12. Peer to Peer Networking
 - a. Ethernet networking card NCE-1000
 - 1) Allows for Peer to Peer panel networking using CAT5 Ethernet Cable
 - 2) Up to 200 panels can be networked together.
 - b. Fiber networking card NCF-1000
 - 1) Allows for Peer to Peer panel networking using fiber optic cable
 - 2) Supports both single mode and multi-mode fiber using SFP pluggable modules
 - 3) Up to 200 panels can be networked together.
- 13. Multi-Connect Expander
 - a. Potter Electric Signal model MC-1000
 - 1) The system shall support a total of 31 Multi-Connect cards.
 - 2) May mount in panel, accessory cabinet, AE-2, AE-8 or AE-14 Accessory Cabinets or the PSN-1000/E Power Supply
 - 3) Allows multiple panels to communicate to a remote station receiver through a single

- panel designated as the host Compatible SLC Devices
14. Analog Addressable Photoelectric Smoke Detector
 - a. Potter Electric Signal model PAD200-PD
 15. Analog Addressable Duct Smoke Detector
 - a. Potter Electric Signal model PAD200-DUCTR
 - 1) The PAD200-DUCTR shall come with one fully programmable (1) Form C Relay
 - 2) Shall require both 24 VDC and SLC to operate
 - b. Potter Electric Signal model PAD200-DUCT
 - 1) PAD200-DUCT does not come with relay
 - c. Potter Electric Signal Duct remote test switch PAD100-DRTS.
 16. 6" Detector base
 - a. Potter Electric Signal model PAD100-6B
 17. 4" Detector Base
 - a. Potter Electric Signal model PAD100-4B
 18. Addressable Detector Base with Low Frequency Sounder
 - a. Potter Electric Signal model PAD100-LFSB
 - 1) Shall require both 24VDC and SLC to operate
 19. Addressable Detector Base with Sounder
 - a. Potter Electric Signal model PAD100-SB
 - 1) Shall require both 24VDC and SLC to operate
 20. Addressable Detector Base with Relay
 - a. Potter Electric Signal model PAD100-RB
 - 1) The relay base shall have 1 set of Form C contacts rated for 2 amps at 24 VDC or 0.5 amps at 125VDC.
 21. Addressable Detector Base with Isolator Module
 - a. Potter Electric Signal model PAD100-IB
 22. Dual Action Pull Station
 - a. Potter Electric Signal model PAD100-PSDA
 - b. Provide Safety Technology International Stopper II cover.
 23. Relay output Module
 - a. Potter Electric Signal model PAD100-TRTI
 - 1) The Two Relay Two Input Module (TRTI) shall have 2 sets of Form C relays, rated for 2 amps at 24VDC or 0.5 amps at 125VAC. Also provides two (2) contacts inputs.
 - b. Potter Electric Signal model PAD100-OROI
 - 1) The One Relay One Input Module (OROI) shall have one form C relay, rated for 2 amps at 24VDC or 0.5 amps at 125VAC. Also provides a single input contact.
 - c. Potter Electric Signal model PAD100-RM
 - 1) Provides one (1) form C relay controlled by the control panel. The relay is rated for 2 amps at 30VDC or 0.5 amps at 125VAC.
 24. Single Contact Input Module
 - a. Potter Electric Signal model PAD100-SIM
 - b. Potter Electric Signal model PAD100-MIM
 - 1) Micro Input Module (MIM) provides a small footprint contact module for mounting inside an enclosure.
 25. Dual Contact Input Module
 - a. Potter Electric Signal model PAD100-DIM
 26. Conventional Initiating Zone Module
 - a. Potter Electric Signal model PAD100-ZM
 27. Monitored Output Module
 - a. Potter Electric Signal model PAD100-NAC
 28. Speaker Output Module
 - a. Potter Electric Signal model PAD100-SM
 29. Short Circuit Isolator Module
 - a. Potter Electric Signal model PAD100-IM
 30. LED Plate
 - a. Potter Electric Signal model PAD100-LED
 31. LED Switch Plate
 - a. Potter Electric Signal model PAD100-LEDK
 32. Remote Test Switch
 - a. Potter Electric Signal model PAD100-DRTS
 33. Notification Appliances
 - a. Audible Indicating Appliances (speakers)

- 1) All audible sounding devices shall operate on 25 or 70.7 VRMS.
- 2) All audible devices shall include field adjustable power tap settings ranging from 1/8 Watt to 4 Watts
- 3) Audible appliances shall be Potter Electric Signal model FASPKR speaker
- b. Visual Indicating Appliances
 - 1) All visual indicating appliances shall operate on 24VDC and be listed as compatible with the FACP.
 - 2) All visual indicating appliances shall support an adjustable candela feature that is set for the appropriate coverage area per NFPA 72.
 - 3) Visual indicating appliances shall meet UL and ADA requirements.
 - 4) Visual indicating appliances shall be Potter Electric Signal Model S-24 for wall mounted applications or model CS-24 for ceiling mounted applications.
- c. Audible/Visual Indicating Appliances (Speaker/Strobes)
 - 1) All visual indicating appliances shall operate on 24VDC and be listed as compatible with the FACP.
 - 2) All visual indicating appliances shall support an adjustable candela feature that is set for the appropriate coverage area per NFPA 72.
 - 3) All audible/speaker appliances shall support adjustable power taps ranging from 1/8 watts to 4 watts.
 - 4) Visual indicating appliances shall meet UL, UL 1480, and ADA requirements.
 - 5) Audible/Visual indicating appliances shall be Potter Electric Signal model SPKSTR-24WLP for wall mounted applications or SPKSTR-24CLP for ceiling mounted applications.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. The entire installation shall be in accordance with NFPA 72, NFPA 70 (NEC), state and local codes, and meet the requirements of the local Authorities Having Jurisdiction.
- B. The installation shall be in accordance with manufacturers' recommended practices and installation instructions.
- C. Smoke detectors shall not be installed until all construction is completed and construction dust and debris are removed. Detectors that were installed in construction areas shall be removed, cleaned, and recalibrated prior to final acceptance.
- D. All conduit, junction boxes, and supports shall be concealed in finished areas and may be exposed in unfinished areas.
- E. Red J-hooks shall be used for fire alarm Class A or Class X circuits including NACs.

3.2 ACCEPTANCE TEST:

- A. All tests shall be conducted in accordance with NFPA 72
- B. Persons conducting fire alarm acceptance tests shall be knowledgeable in fire alarm systems. This is verified by the proper training and recognition from within the factory, NICET, International Municipal Signal Association, State or locally certified, or trained by a company that is listed by a national testing laboratory.
- C. The fire alarm test shall be thorough and test 100% of all circuit, devices, and signals. That test shall include but not be limited to the following:
 1. Prior to powering the system, check for ground faults, short circuits, and continuity.
 2. Test the supervisory valves connected to the fire suppression system for a supervisory signal sent to the panel.
 3. Test all sprinkler waterflow switches. Retard times shall not exceed 90 seconds.
 4. Open and short each SLC circuit and verify a trouble condition occurs.
 5. Open and short each notification appliance circuit and verify a trouble condition occurs.
 6. Ground all circuits and verify a trouble condition occurs.
 7. Verify the installation is in accordance with the approved drawings.
 8. Test audibility of all audible notification appliances and that the output volume is in accordance with NFPA 72.
 9. Test all visual notification appliances for synchronization and proper operation.

10. Test the operation of every addressable device on the system per manufacturer's recommendations.
11. Verify the appropriate outputs are activated when each input device is put into an alarm condition.
12. Verify the appropriate messages are displayed and LED's illuminate on the FACP and remote annunciators, corresponding to each point tested.

3.3 OPERATOR INSTRUCTION:

- A. The manufacturer-trained representative shall instruct and demonstrate to the building owner the operation of all system components. An operator's manual shall be provided and kept with the FACP for future reference. A drawing or list shall be provided to the building owner detailing the device locations, addresses, and programming of each system device. If requested, the installation contractor shall provide a typewritten sequence of operations.

END OF SECTION

SECTION 270500

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

- 1.1 SUMMARY
 - A. Structured cabling for voice and data
 - B. Grounding and Bonding
 - C. Cable Pathways
 - D. Cable Management
 - E. Outfitting of Communication Equipment Rooms
- 1.2 RELATED WORK SPECIFIED UNDER OTHER DIVISIONS
 - A. Foundations and pads required for equipment furnished under this Division
 - B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.
 - C. Flashing of conduits into roofing and outside walls.
 - D. Heating, ventilating, and air conditioning equipment.
 - E. Electrical service to equipment rooms.
 - F. Cutting and patching for low voltage systems work, except for errors and omissions under this Division.
- 1.3 RELATED WORK - OWNER FURNISHED EQUIPMENT AND SYSTEMS
 - A. Telephone system electronics
 - B. Data network electronics
 - C. Computer workstations, servers, printers and other peripherals
- 1.4 QUALITY ASSURANCE
 - A. Contractor shall identify all types of quality control mechanisms they employ. Please list.
 - B. Perform work in accordance with contract documents.
 - C. All personnel performing the work of this Section shall be thoroughly familiar with the cabling methods set forth in the latest release of the BICSI TDMM (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals).
 - D. Contractor's RCDD shall review all required work prior to commencing. The Contractor's RCDD shall oversee the installation and will have the end responsibility for the quality of the installation work performed. All submitted designs and or changes to the design shall be approved and signed off by the Contractor's RCDD.
 - E. The installed cabling systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades cabling systems.
 - F. Expansion Capability: Unless otherwise indicated, provide spare positions in wall fields, cross connects, and terminal strips, and space in cable pathways to accommodate twenty (20) percent future growth in campus distribution and riser.
 - G. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the permanent link and channel measures shall meet or exceed the lower channel's specified parameters.
 - H. Component Compliance: The provided solution's components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent and channel, regardless of the fact that tests for permanent and channel ultimately meet required specifications.
 - I. Pre-installation inspection: Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

- J. Test optical fiber cable while on reels. Use an optical time domain reflectometer (OTDR) to verify the cable length and locate cable defects, splices, and connector, including the loss value of each.
- K. Test each pair of UTP cable for open and short circuits. Test results to be submitted to Owner.
- L. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.5 STANDARDS

- A. The Contractor's performance of the Work shall comply with applicable federal, state and local laws, rules and regulations. The Contractor shall give required notices, shall procure necessary governmental licenses, permits, and inspections and shall pay without burden to The Owner, all fees and charges in connection therewith unless specifically provided otherwise. In the event of violation, the Contractor shall pay all fines and penalties, including attorney's fees and other defense costs and expenses in connection therewith.
- B. Federal Communications Commission
 - 1. Equipment requiring FCC registration or approval shall have received such approval and shall be appropriately identified.
- C. Codes, Standards and Ordinances
 - 1. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA 70 (National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:
 - a. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
 - b. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 - c. ANSI and TIA Standards
 - 1) ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 - 2) ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
 - 3) ANSI/TIA-568.2-D – Balanced Twisted Pair Telecommunications Cabling and Components Standard, 2018
 - 4) ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard, 2016
 - 5) ANSI/TIA-568.3-D-1 – Optical Fiber Cabling and Components Standard - Addendum 1: General Updates, 2019
 - 6) ANSI/TIA-568.4-D - Broadband Coaxial Cabling and Components Standard, 2017
 - 7) ANSI/TIA-569-E – Telecommunications Pathways and Spaces, 2019
 - 8) ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure, 2021
 - 9) ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
 - 10) ANSI/TIA-526.7-A – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, 2015
 - 11) ANSI/TIA-526.14-C – Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant, 2015
 - 12) ANSI/TIA-758-B – Customer-Owned Outside Plant Telecommunications Infrastructure Standard, 2012
 - 13) ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
 - d. NEMA-VE-1 – Metal Cable Tray Systems, 2009
 - e. NEMA-VE-2 – Metal Cable Tray Installation Guidelines, 2006
 - f. NFPA-70 – National Electrical Code
 - g. Install cabling in accordance with the most recent edition of BICSI® publications:
 - 1) BICSI – Telecommunications Distribution Methods Manual, 14th Edition
 - 2) BICSI – Information Technology Systems Installation Methods Manual, 8th Edition
 - h. Federal, state, and local codes, rules, regulations, and ordinances governing the Work, are as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the Owner's Representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

- i. American Society for Testing and Materials (ASTM): ASTM E. 814 – Standard Test Method for Fire Tests of Penetration Firestop Systems
- j. Underwriters Laboratories, Inc. (UL): UL 1479 – Tests of Through-Penetration Firestop Systems
- k. Americans with Disabilities Accessibility Guidelines.
- l. Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 (OSHA).
- m. Uniform Building Code (UBC).
- n. International Building Code (IBC).
- o. Texas Department of State Health Services (TDSHS).
- p. Applicable codes and directives of authorities having jurisdiction

1.6 COMPLETENESS OF WORK

- A. The Contract Documents depict low voltage systems which are intended to be complete and functioning systems. All products, materials, labor, and programming necessary to render a fully functional system to fulfill the design intent shown on the documents shall be provided by the Contractor.
- B. Catalog numbers referenced throughout this Division's drawings and specifications are intended to convey a general understanding of the type of quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra charge shall be allowed because a catalog number is found to be incomplete or obsolete.

1.7 PRE-INSTALLATION CONFERENCE

- A. Arrange and schedule pre-installation conference prior to beginning any work of this section Communications.
- B. Agenda: Clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/Owner representative.
- C. All individuals, who will be in an on-site supervisory capacity, shall be required to attend the pre-installation conference. This includes project managers, site supervisor and lead installers. Individuals who do not attend the conference will not be permitted to supervise the personnel that install, terminate, or test communications cables on the project. The Contractor's RCDD that will oversee the installation is required to attend the pre-installation conference.
- D. The manufacturer that will be providing the extended warranty is required to have a representative attend the pre-installation conference.

1.8 SEQUENCE AND SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and if accepted will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- D. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, Owner acceptance, and demolition completion.

1.9 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Produce Shop Drawings for all Sections which include the requirement.
- C. Provide Product submittals for all Sections which include the requirement. All product submittals must include all products, accessories, and options clearly identified within the submittal.
- D. Contractor shall not utilize the Consultants' original design drawings in the submittal or shop drawing process. Contractor shall develop their own original shop drawings.

1.10 ALTERNATES, SUBSTITUTIONS AND CHANGE ORDERS

- A. If a proposed alternate material is equal to or exceeds specified requirements, Contractor shall provide manufacturer's specifications in writing for written approval prior to purchase and installation of proposed materials. The proposed material substitution shall not void or change manufacturer's warranty.
- B. Contractor shall provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing. Contractor shall respond to these changes with a complete material list, labor, and taxes in writing presented to the Owner for approval. Contractor shall not proceed with additional scope of work without a signed approval by the Owner.
- C. Additional work performed by the Contractor will not be paid by Owner without signed approval of these changes prior to implementing changes. Submit a copy of signed change order upon billing.

1.11 USE OF THE SITE

- A. Use of the site shall be at the Owner's direction in matters in which the owner deems it necessary to place restriction.
- B. Access to building wherein the Work is performed shall be as directed by the Owner.
- C. The Owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner's operations.
- D. Schedule necessary shutdowns of plant services with the Owner and obtain written permission from the owner. Refer to article - CONTINUITY OF SERVICES herein.
- E. Proceed with the Work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.
- F. All Contractor personnel must check in with the facilities engineering department and/or the General Contractor upon arrival and upon departure.

1.12 DELIVERY AND STORAGE

- A. Insofar as possible, deliver items in manufacturers' original unopened packaging. Where this is not practical, cover items with protective materials, to keep them from being damaged. Use care in loading, transporting, unloading, and storage to keep items from being damaged.
- B. Store items in a clean dry place and protect from damage.
- C. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- D. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- E. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- F. Contractor is responsible for on-site security of tools, test equipment and materials.
- G. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.13 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 1 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 - 3. As-built cable schedules with recorded cable routing and lengths of each designated run.
 - 4. As built documentation of all cabling systems.
 - 5. As built documentation of CR/IDF modifications and associated cabinet elevations.
- B. Warranty and Maintenance:
 - 1. Test Report Binder(s)
 - 2. Record Drawings

1.14 RECORD DRAWINGS

- A. Keep a hard copy set of project drawings at the job site exclusively for recording deviations from the Construction Drawings.

- B. Record locations and depths of buried and concealed conduits from fixed, easily identifiable objects, such as building walls. Where conduits are concealed in walls, indicate distances off of building corners or other building features not likely to be disturbed by future alterations.
- C. Mark deviations in a different color so that work of various systems can be easily identified.
- D. When Work is completed, record all deviations in an electronic format using AutoCAD 2007 in a format usable to the Owner. Coordinate this format with the Owner.
- E. Submit two copies of completed "record drawings" on electronic media such as CD or DVD to Owner's Representative for distribution.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. All materials and equipment used in carrying out these specifications are to be new and have UL listing, or listing by other recognized testing laboratory when such listings are available.
- B. Model numbers and manufacturers included in this specification are listed to establish as standard of product quality.
- C. Other qualified manufacturers may be substituted only with The Owner's written consent. To request a substitution, the Contractor shall submit complete technical data, samples, and if requested, results of independent testing laboratory tests of proposed equipment.
 - 1. If proposed System includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review.
 - 2. Material not specifically identified within this document, but which is required for the successful implementation of the intended system(s), shall be of the same class and quality as the specified material and equipment.
 - 3. Include a list of previously installed projects using proposed equipment that are similar in nature to specified system.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Insofar as it is possible to determine in advance, advise the General Contractor to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required is to be done at this Contractor's expense. Visit site and be informed of conditions under which work must be performed. No subsequent allowance will be made because of error or failure to obtain necessary information to completely estimate and perform work involved.
- B. Carefully coordinate with other divisions to ensure proper power requirements, grounding, fireproofing and interlocking controls between the fire alarm system, security system, and other owner furnished systems.
- C. Notify other tradesmen of any deviations or special conditions necessary for the installation of work. Interferences between work of various Contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to Owner.
- D. The Owner or the Owner's Representative shall be the mediating authority in all deviation and disputes arising on project.
- E. Coordinate with local telephone and cable service providers to assure that proper points of service, demarcation location and grounding requirements are in accordance with contract drawings. Duct bank is to be provided by Division 26. This Contractor shall be involved regarding discussions about services to the building.
 - 1. Coordinate with other trades to provide wall and ceiling access panels wherever required for access to communication equipment.
- F. Intent:
 - 1. These sections of specifications and drawings form a complete set of documents for communications systems for this project. Neither is complete without the other. Any item mentioned in one shall be as binding as though mentioned in both.
 - 2. The intent of these specifications and drawings is to form a guide for a complete systems installation. Where an item is reasonably necessary for a complete system but not specifically

- mentioned, such as pull boxes, fittings, expansion fittings, support hangers, etc. provide same without additional cost to Owner.
3. Communication equipment room layouts indicated on drawings are diagrammatical only. Exact location of outlets and equipment to be coordinated and governed by project conditions. The Designer reserves the right to make any reasonable changes (approximately 6 feet) in location of junction boxes, or equipment prior to roughing in of such without additional cost to Owner.
- G. Deviations:
1. No deviations from specifications and drawings to be made without full knowledge and consent of Designer.
 2. Should the Contractor find during progress of work that existing conditions make desirable a modification of the requirements of any particular item, report such item promptly to Designer for his decision and instructions.
- H. Main Horizontal Pathway/Raceway
1. Unless otherwise noted on the drawings, all communications/low voltage systems cabling shall be routed above accessible corridor ceilings parallel to room walls and corridors via cable tray or J-hook supports. Cabling shall be segregated by function as follows:
 2. Voice/data cabling.
 3. All other systems.
- 3.2 CONTINUITY OF SERVICES
- A. The Contractor shall not take any action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the owner's representative. Arrange the Work to minimize shutdown time.
 - B. Owner's personnel will perform shutdown of operating systems. The Contractor shall give three (3) days' advance notice for systems shutdown.
 - C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.
- 3.3 TRENCHING, EXCAVATION, BACKFILLING, AND REPAIRS
- A. Trenching, Excavation, and Backfilling is the responsibility of the General Contractor. This Contractor is to coordinate all requirements with the GC. Failure to properly coordinate this effort resulting in additional trenching, excavation, backfilling, or repairs shall be performed without additional cost to Owner.
- 3.4 PLYWOOD BACKBOARD AND WALL BACKING
- A. Contractor shall provide 4-foot wide, by 8-foot high, by 3/4-inch thick fire retardant plywood backboard as indicated in all Communication Rooms. Plywood is to be painted with two coats of flat white fire-retardant paint on all six sides and installed 6 inches above finished floor, unless noted otherwise. The fire rating on the plywood shall be masked prior to painting and the mask removed after installation such that the fire rating is always visible.
 - B. General Contractor is to provide appropriate backing in walls as required for mounting brackets and other wall mounted equipment per manufacturer requirements.
 - C. Where work is to be done in an existing Telecommunication Room (TR), the Contractor shall ensure plywood in the TR is flame retardant. If the existing plywood does not comply the Contractor shall replace it with plywood compliant with ..A.
- 3.5 FIRESTOPPING
- A. Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications penetration and base each selection on criteria specified herein.
 - B. Selected systems shall not be less than the hourly time delay ratings indicated in the Contract Documents for each respective fire-rated floor, wall, or other partition of building construction. Firestop for each type of communications penetration shall conform to requirements of an independent testing laboratory design drawing or manufacturer's approved modification when used in conjunction with details shown on the Drawings.
 - C. Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

- D. Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.
- E. Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.
- F. Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of Firestopping. Remove combustible installation aids after firestopping material has cured.
- G. All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.
- H. Existing raceways, cable trays, and cabling that penetrate existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
- I. If required by inspecting authorities:
 - 1. Expose and remove Firestopping to the extent directed by inspecting authority to permit his or her inspection.
 - 2. Reinstall new firestopping and restore Work where removed for inspection.

3.6 TESTS

- A. On completion of Work, installation shall be entirely free of damaged conductors, software errors, incomplete jack termination including labeling and faceplates and dust. Perform a thorough operation test in the presence of the Owner or their representative. Provide documentation of all test results as outlined in each system's specifications. Include labor, materials and instruments for above tests.
- B. Furnish owner, as a part of closing documents, a copy of such tests including identification of each cable, also the dedicated communication service ground test as required by each system's individual manufacturer indicating compliance with their requirements.
- C. Prior to final observation and acceptance, test and leave in satisfactory operating condition, all systems and equipment including but not limited to the following:
 - 1. Grounding.
 - 2. Firestopping of all sleeves and conduits.
 - 3. Telephone and LAN systems.
 - 4. Turn in test results on cabling.

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, dust, and construction debris and repair damaged finish, including chips, scratches, and abrasions. This includes touching up paint removed for grounding.
- B. Contractor shall provide a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- C. Maintain construction materials and refuse within the area of work. Clean the work area at the end of each day.
- D. Contractor shall keep all liquids (drinks, Sodas, etc.) off finished floors, carpets, tiles, racks and equipment. If any liquid damage to above finishes or equipment, Contractor shall provide professional services to clean or repair scratched/soiled finishes or damaged equipment at own expense

3.8 INSPECTION FEES AND PERMITS

- A. Obtain and pay for all necessary permits and inspection fees required for communication systems installation. Work shall not start until all permit applications are approved.

3.9 OBSERVATIONS

- A. When field observation services are a part of the project scope, the Designer's office will provide periodic observation of the progress of Work specified herein. The purpose of the observation service is to ensure compliance of Contractor's Work with specifications and drawings. The Designer's office may also observe tests required of this Contractor as called for in other sections of the specifications.

- B. Specifications and drawings represent Work to be done in view of total project requirements. To eliminate possible conflict with other trades, final location of conduits, jacks, outlets, components, etc., is responsibility of this Contractor. Contractor to provide all supervision required for his personnel to ensure that installation is made in accordance with specifications and drawings and all safety rules and regulations are observed. In event of conflicts of Work on project with other trades, Contractor is to make every reasonable effort to resolve conflict through meetings and discussions with other parties involved, by preparation of drawings, or other appropriate action. Only after this has been done shall the Designer's assistance be requested through the RFI process.
- C. When the Designer is requested to visit the project to aid in resolution of conflicts, or for witnessing tests, they shall be given a minimum of 48 hours' notice prior to time their presence is requested at job site.

3.10 WARRANTY-GUARANTEE

- A. The Designer reserves right to accept or reject any part of the installation which does not successfully meet requirements as set out in these specifications.
- B. This Contractor shall, and hereby does, guarantee all Work installed under this division shall be free from defects in workmanship and materials for a period of one year from date of final acceptance. This Contractor further agrees to repair or replace any defective material or workmanship which is or becomes defective within the terms of this warranty-guarantee.
- C. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

END OF SECTION

SECTION 270528

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of communications cable pathways outside of Telecommunications Rooms.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Metallic Ladder Cable Tray
 - 2. Non-Continuous Cable Support Systems
 - 3. Fire-Rated Pathway Devices
 - 4. Conduit Systems
 - 5. Junction Boxes/ Pull Boxes

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. AFF Above Finished Floor
 - 2. ANSI American National Standards Institute
 - 3. ASTM American Society for Testing and Materials International
 - 4. BICSI Building Industry Consulting Service International
 - 5. BOCA Building Officials and Code Administrators International
 - 6. EMT Electrical Metallic Tubing
 - 7. HVAC Heating, Ventilating and Air Conditioning
 - 8. NEC National Electric Code
 - 9. NECA National Electrical Contractors Association
 - 10. NEMA National Electric Manufacturers Association
 - 11. NFPA National Fire Protection Association
 - 12. OAR Owner's Authorized Representative
 - 13. OD Outer Diameter
 - 14. RCDD Registered Communications Distribution Designer
 - 15. RMC Rigid Metallic Conduit
 - 16. STD Standard
 - 17. TIA Telecommunications Industry Association
 - 18. UL Underwriters Laboratories

1.3 QUALITY ASSURANCE

- A. All cable and equipment must be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents must be subject to the control and approval of the OAR.
- B. Equipment and materials must be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment must be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI and TIA recommended installation practices when installing cable pathways.
- D. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of Electrical Systems or Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician must be a full-time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager must be assigned for the duration of the project and must not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein must comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial building Telecommunications Cabling, 2006
 3. ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 4. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
 5. ANSI/TIA-569-E – Telecommunications Pathways and Spaces, 2019
 6. ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure, 2021
 7. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
 8. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
 9. NFPA 70 – National Electric Code
 10. BICSI – Telecommunications Distribution Methods Manual, 15th Edition
 11. NEMA – VE 1 – Metal Cable Tray Systems, 2009
 12. NEMA – VE 2 – Metal Cable Tray Installation Guidelines, 2006
 13. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work must be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- 1.4 CONFLICTS
- A. This installation must be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.
- 1.5 PERMITS
- A. The Contractor must secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.
- 1.6 SCHEDULING
- A. The Contractor must comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor must provide a detailed schedule of work to be performed. This schedule must be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.

- C. The successful Contractor for all or any portion of the work described by this specification package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein must be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL horizontal and vertical pathways, to include but not limited to, dimensions/size of pathway, routing placement and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as vertical and horizontal offsets and transitions.
- D. Provide all submittal requirements under this section as a single package.
- E. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
 - 3. As built documentation of all pathway systems to include cable tray, conduits (horizontal and vertical), and non-contiguous support.
- B. Warranty and Maintenance:
 - 1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor must coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment must be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation must be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period must have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 WIRE MESH CABLE TRAY, SUPPORTS, AND ACCESSORIES

- A. Wire Mesh Cable Tray
 - 1. Provide wire mesh cable tray as shown on the drawing set.
 - 2. Wire mesh cable tray must be manufactured from round steel wire that is a minimum of .196" (5mm) in diameter. Wires must be welded at intersections to form a 2" x 4" (50.8mm x 101.6mm) grid pattern. The tray must be U-shaped with equal height sidewalls.
 - 3. Follow cable tray sizes as indicated on the drawings.
 - 4. Tray ends will be formed downward at 90° to allow easy drop-in installation with approved supports.
 - 5. Wire mesh cable tray must be zinc electroplated after fabrication.
 - 6. Wire mesh cable tray must be UL Classified for grounding purposes.
 - 7. Acceptable systems (size as shown on plans):
 - a. Cablofil CF105/450EZ
 - b. Chatsworth 34821-518
 - c. Cooper B-Line FT4X18EG
 - d. Owner Approved Equivalent.
- B. Wire Mesh Cable Tray Supports
 - 1. Supports will be sized at minimum to match the width of the wire mesh cable tray that is supported. The support may be wider than wire mesh cable tray.
 - 2. Support design will allow the support to be placed under a wire mesh cable tray at any point mid-span or directly under a pathway splice or intersection.
 - 3. Each support location will utilize a trapeze mounted support bracket in the cable tray, allowing drop-in of installed cabling.
 - 4. Each support will be punched with an alternating obround and round hole-pattern that accepts wire mesh cable tray ends which are formed downward at 90° and self-threading splice plate attachment hardware.
 - 5. When placed directly under a splice or intersection, the support will allow drop-in attachment of cable tray. Splice hardware will splice cable trays and secure wire mesh cable trays to the support.
 - 6. Supports will be manufactured from steel extrusion and/or sheet.
 - 7. Wire Mesh Cable Tray Supports will be zinc electroplated after fabrication.
 - 8. Acceptable products:
 - a. Cablofil FASP 700
 - b. Chatsworth 34730-524
 - c. Cooper B-Line FTB24CT
 - d. Owner Approved Equivalent.
- C. Wire Mesh Cable Tray Splices and Fasteners

1. Provide a method of simultaneously splicing, bonding and securing intersecting wire mesh cable tray sections to supports when supports are placed directly under a wire mesh cable tray pathway at a splice point, intersection point, or at the beginning or end of a change in elevation.
2. Provide a method of splicing and bonding wire mesh cable tray sections together at a splice point or an intersection point that is not located directly over a support.
3. Provide a method for bonding and securing wire mesh cable tray to supports when supports are placed mid-span (in between a splice or intersection point) along a wire mesh cable tray pathway.
4. Provide a method for attaching a bonding conductor to the wire mesh cable tray.
5. Acceptable products:
 - a. Cablofil
 - 1) EDRN
 - 2) GNDSB
 - 3) GNDCL
 - b. Chatsworth
 - 1) 34738-501
 - 2) 34739-501
 - 3) 34838-001
 - c. Cooper B-Line
 - 1) FSTLCZN
 - 2) GROUND BOLT
 - d. Owner Approved Equivalent

D. Wire Mesh Cable Tray Accessories

1. Provide a bend radius to connect the sidewalls of adjoining wire mesh cable tray wherever a splice or an intersection in the cable tray pathway results in a 4" or wider gap between the sidewalls. The bend radius should be the same height as the sidewalls of the wire mesh cable tray.
2. Provide elevation change hinges to form cable over a smooth curve wherever cable tray changes elevations.
3. Provide conduit adapters for all conduit that transitions into the cable tray.
4. Wire mesh cable tray accessories will be manufactured from steel extrusion and/or sheet.
5. Wire mesh cable tray accessories will be pre-galvanized before fabrication.
6. Acceptable products:
 - a. Cablofil
 - 1) Part Number RADT90KIT Bend Radius Kit
 - 2) Part Number EAC Elevation Change Kit
 - 3) Part Number CE40CC & CH Conduit Adapter
 - b. Chatsworth 34740-501 Bend Radius Kit
 - c. Cooper B-Line
 - 1) Part Number 90 DEGREE KITEG Bend Radius Kit
 - 2) Part Number FTxxxCCGLV Conduit Connector
 - d. Owner Approved Equivalent

E. Wire Mesh Cable Tray Installation Tools

1. Provide cutting and forming tools, as required, for field fabrication of wire mesh cable tray pathways without leaving burrs or sharp edges.
2. Provide tools, as required, for pulling cable around turns, bends or intersections in wire mesh cable tray pathway.

F. Wire Mesh Cable Tray Support – Installation Hardware

1. Provide installation hardware to attach wire mesh cable tray supports to building structure.

2.3 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. Non-Continuous Cable Supports (J-Hooks)

1. Non-continuous cable supports must provide a complete horizontal and vertical 1" bend radius control to help prevent degradation of cable performance.
2. Must be UL 2043 listed and suitable for use in air handling spaces.
3. Cable tie channel allows user to easily install Panduit Tak-Ty® Cable Ties to retain cable bundle.

4. Approved Products:
 - a. Panduit J-PRO Cable Support System
 - b. Owner Approved Equivalent

2.4 FIRE-RATED PATHWAY DEVICES

- A. Provide through-wall fire-rated pathway devices, as required.
 1. Cables penetrating through fire-rated floors or walls must utilize fire-rated pathway devices capable of providing an F rating equal to the rating of the barrier in which the device is installed.
 2. The device must be tested for smoke leakage (L rating) and must not require the use of any optional sealing materials to achieve the published rating.
 3. The device must utilize a fire and smoke sealing system that automatically adjusts to the addition or removal of cables.
 4. Pathway devices must be capable of allowing a 0 to 100-percent visual fill of cables.
 5. Pathway devices must be of a sufficient size to accommodate the quantity and size of data cables required and must be suitable for use with new or existing cable installations.
 6. The installed device (in normal use) must require no maintenance and must accommodate future cable changes without mechanical adjustment and/or removal or replacement of protective materials.
 7. Provide all necessary accessories for multi-gang support, cable radius control, and labeling.
 8. Approved Products:
 - a. STI EZ-PATH Series 44
 - b. Owner Approved Equivalent

2.5 CONDUIT SYSTEMS

- A. General
 1. All conduit system components must be UL rated.
 2. All conduit system components must comply with the NEC.
 3. All conduit fittings, junction and pull boxes must provide minimum cable bend radius in accordance with ANSI/TIA-569.
 4. All conduit fittings must have plastic bushings on all exposed conduit ends.
- B. Rigid Metal Conduit (RMC) and Fittings Before Coating:
 1. RMC must be UL6 listed and conform to ANSI C80.1, ANSI C80.4 and NEC Article 344.
 2. RMC coating must comply with WW-C-581d.
- C. Electrical Metallic Tubing (EMT):
 1. EMT must be UL listed and conform to NEC Article 358.
 2. EMT fittings must be formed steel compression ring type. Die cast fittings are not allowed.
 3. Only manufacturer's fittings, adapters, and terminators must be used.
 4. All transition junction and pull boxes, fittings terminators and adapters must be a metallic material.
 5. Must be used inside buildings only.
- D. Flexible conduit is not permitted.
- E. Conduit Bodies are not permitted.
- F. Non-metallic conduits are not permitted in above ground installations.
- G. Conduit Fittings
 1. All above ground fittings must be of metallic material.
 2. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
 3. All fittings must be compression or threaded.
 4. Fittings must provide a secure connection for pulling communications cables.
 5. Setscrew fittings are not permitted.

2.6 JUNCTION BOXES / PULL BOXES

- A. All pull boxes must be constructed with a minimum of 14-gauge galvanized steel with an ANSI 61 grey polyester powder finish inside and out over phosphatized surfaces or galvanized steel unless otherwise specified.

- B. All pull boxes must be minimum NEMA Type 1 rated in indoor spaces. Pull boxes must be minimum NEMA Type 3R rated in outdoor locations. Boxes are to be sized according to the table below unless otherwise specified.
- C. All pull boxes must have flat, removable covers fastened with plated steel screws within unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.
- D. All removable box covers must be connected to box with a safety strap or chain.

Maximum Trade Size of Conduit (inches)	Minimum Box Size (inches)			For Each Additional Conduit Increase Width (inches)
	Width	Length	Depth	
1	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2	8	36	4	5
2.5	10	42	5	6
3	12	48	5	6
3.5	12	54	6	6
4	15	60	8	8

- E. All pull boxes must provide the appropriate provisioning for grounding.

PART 3 – EXECUTION

3.1 GENERAL

- A. Raceways must be mechanically and electrically connected to all boxes and fittings and must be properly grounded per NEC.
- B. The routing and location of all conduits, cable tray, cable hooks and other raceways must be coordinated with other trades prior to and during building construction to avoid delays and conflicts.
- C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation that will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.
- D. All Raceways must be run at least 6-inches from hot flues, steam pipes, hot water pipes and other hot surfaces.
- E. All raceways entering a building from underground must be sealed to prevent water, moisture, gas, or other foreign matter from entering the building. Service conduits must be sealed in accordance with NEC 230-8.
- F. Contractor's on-site RCDD supervisor must review, approve and stamp all shop drawings, coordination drawings and records drawings.
- G. DO NOT route communication pathways under HVAC condensing units.
- H. Expansion Fittings:
 - 1. Raceways must be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
 - 2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.

3.2 INSTALLATION

- A. Wire Mesh Cable Tray

1. Installation and configuration must conform to the requirements of the current revision levels of ANSI/TIA Standards 568 & 569, NEMA VE2 (Cable Tray Installation Guidelines), NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
 2. Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.
 3. Maintain a minimum of 12 inches of clearance above cable tray and 12" to one side of cable tray to allow access to facilitate cable installation. Maintain a minimum of 3 inches between ceiling tile and cable tray support.
 4. Cable tray fitting supports must be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions
 5. Cable tray should be free of burrs and sharp edges.
 6. Cable tray must be grounded according to manufacturer's specifications.
 7. Splice hardware shall be installed according to the manufacturer's instructions.
 8. Support hardware shall be installed according to the manufacturer's instructions.
- B. Non-Continuous Cable Support Systems (J-hooks)
1. Non-continuous cable support systems must only be allowed to support a single outlet routed above accessible ceilings. Where pathways consist of more than a single outlet or are located in other areas they must not receive non-continuous cable support systems.
 2. Installation and configuration must conform to the requirements of the current revision levels of ANSI/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
 3. Cable hooks must be capable of supporting a minimum of 30 pounds with a safety factor of 3.
 4. Install cables without damaging conductors, shield, or jacket.
 5. Do not exceed load ratings specified by manufacturer.
 6. Adjustable non-continuous support sling must have a static load limit of 100 lbs.
 7. Cable Hook spacing maximum 5 feet on center.
 8. Maintain maximum cable sag between cable hooks of 12 inches.
 9. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.
- C. Firestopping
1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.
 2. Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.
 3. Install firestopping to comply with performance requirements specified herein.
 - a. Install firestopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements.
 - b. Installer must be trained and approved by the manufacturer.
 4. Protect installed products from damage during construction operations until final completions.
 5. Inspection: Code official or building inspectors to review proper installation using manufacturer's guidelines.

3.3 CONDUIT INSTALLATION

- A. Conduit must be installed with threaded fittings and couplings.
- B. All metallic couplings, connectors and fittings must be malleable iron or Steel and finished with Zinc plating or by Galvanizing.
- C. All conduits must be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits must be swabbed and cleaned before wires are pulled.
- D. Expansion fittings must be utilized in all cases where conduits pass through building expansion joints. Fittings must be of an approved weatherproof telescopic type bonding jumper around or through the fitting.
- E. Connection of Conduit to Pull / Junction Boxes and Enclosures:
1. Connection to NEMA 1 type boxes and enclosures:
 - a. Rigid conduit: Install insulated bushings and double locknuts.
 - b. EMT: Install compression box connectors with insulated throats.

2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.
 3. When conduits enter floor mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the given circuit.
 4. Install sealing bushing within all conduits which have entered a building from outside, whether from above or below grade.
- F. Each Conduit route must be installed with the least amount of bends as possible. No section of conduit must be longer than 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend) between pull points, pull boxes or reverse bends.
- G. The inside radius of bends in conduit must be.
1. 6 times the internal diameter for 2-inches or less.
 2. 10 times the internal diameter for greater than 2-inches.
- H. A measured pull tape must be placed in all installed conduit.
- I. Any single conduit run extending from a CR/IDF must not serve more than one outlet.
- J. Conduit must be reamed to eliminate sharp edges and terminated with an insulated bushing.
- K. Conduit protruding through the floor must be terminated at a minimum of 3 inches above the floor surface.
- L. All stubbed conduit ends must be provided with a ground bushing.
- M. All conduit penetrations must be provided with the proper conduit sleeves.
1. Sleeves must extend three inches AFF or four inches below finished ceiling, with a bushing.
 2. Sleeves must be installed in the communications room floor or ceiling a minimum of two to four inches on center from the wall.
 3. Conduit floor sleeves must be spaced to allow space for ground bushing and insulated bushing for cable protection.
 4. Must be installed in a single tier or row from left to right horizontally. If two tiers or rows are required, the conduits must be staggered minimum of 2 inches between tiers.
 5. Cable support anchors must be installed 18 to 24 inches above the sleeves.
- N. All cable (horizontal, riser or backbone) wall or ceiling penetrations must be provided with the proper conduit sleeves.
1. Sleeves must extend three inches AFF or four inches below finished ceiling, with a bushing.
 2. Sleeves must be installed in the floor or ceiling a minimum of two to four inches on center from the wall.
 3. Sleeves must be installed in the walls at a minimum of two inches extended on each side of the wall.
 4. Cable floor, ceiling and wall sleeves must be spaced to allow space for ground bushing and insulated bushing for cable protection.
 5. Must be installed in a single tier or row from left to right horizontally.
 6. If two tiers or rows are required, the conduits must be staggered minimum of 2 inches between tiers.
 7. Cable support anchors must be installed 18 to 24 inches above the sleeves.
- O. All conduit and cabinet entrances must be sealed with an approved, re-enterable sealant material to prevent ingress of water, dust or other foreign materials.
- P. Conduit must not be embedded in the required fire protective covering of a structural member that is to be individually encased in accordance with BOCA.
- Q. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.
- R. Conduit Sizing and supports:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
 2. Each horizontal conduit run must be a one-inch metallic conduit and must be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
 3. Each route must be installed with the least amount of conduit bends. Each single horizontal conduit run must be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).

4. Each dual horizontal conduit run must be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box must equal the number of conduits exiting the Junction or Pull Box.
 5. Each terminating (outlet end) conduit connection must be provided with the proper connecting insulated bushing or fitting.
 6. Each originating end (communications room end) must be provided with the proper connecting insulated ground bushing and properly bonded to ground.
- S. Horizontal Conduit Routes:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
 2. Each horizontal conduit run must be a one-inch metallic conduit and must be home run from each communications outlet box to the equipment room, termination equipment or cable tray, as indicated in Drawings.
 3. Each route must be installed with the least amount of conduit bends. Each single horizontal conduit run must be provided with a junction or pull box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend).
 4. Each dual horizontal conduit run must be provided with a Junction or Pull Box every 30 meters (100 feet) or contain more than two 90-degree bends (offset is considered to be a 90-degree bend). The quantity of conduits entering the Junction or Pull Box must equal the number of conduits exiting the Junction or Pull Box.
 5. Each terminating (outlet end) conduit connection must be provided with the proper connecting insulated bushing or fitting.
 6. Each originating end (communications room end) must be provided with the proper connecting insulated ground bushing and properly bonded to ground.
- T. Horizontal conduit entrance in communications rooms – wall entry
1. Horizontal conduits must enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.
 2. Conduit wall stubs must be spaced in increments equal to the conduit outside diameter (OD) from each other.
 3. All conduit wall stubs must be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
 4. Conduit crossovers are not permitted.
- U. Horizontal conduit entrance in communications rooms – ceiling entry
1. Horizontal conduits must enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.
 2. Ceiling conduit stubs must be spaced in increments equal to the conduit outside diameter (OD) from each other.
 3. All ceiling conduit stubs must be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
 4. Conduit crossovers are not permitted.
- V. Horizontal conduit entrance in communications rooms – floor entry
1. Horizontal conduits must enter the communications room floor 2 to 4 inches on center from the wall and must be stubbed 3 inches AFF.
 2. Conduit floor stubs must be spaced in increments equal to the conduit OD from each other.
 3. Conduit crossovers are not permitted.
 4. Provide vertical ladder rack or d-hooks properly secured to wall to transverse cable to cable tray over-head.
- W. Horizontal conduit to cable tray
1. Non-communications conduit must NOT be attached to the cable tray in any fashion.
 2. Conduit terminating end must be attached to cable tray side rail with "conduit-to-cable tray" clamps. No other form of attachment must be permitted.
 3. Top or bottom cable tray conduit feeds and attachments are not permitted.
- X. Horizontal Junction/Outlet Boxes
1. Each horizontal conduit must be terminated into an outlet box.
 2. Each outlet box must be a deep 4 11/16-inch square junction box with a minimum of two 1-inch knockouts on each of the sides.

3. Each conduit home run must be provided with a deep 4 11/16-inch square junction box (w/cover) at 100-foot intervals and 6 inches above each ceiling and wall intersection.
- Y. Riser conduit entrance in communications rooms – wall entry
 1. Riser conduits must enter the communications room wall a minimum of 24 inches above the top of the cable tray.
 2. Conduit wall stubs must be spaced in increments to equal the conduit OD from each other.
 3. Riser conduits must be installed in a single tier or row from left to right horizontally.
 - a. If two tiers or rows are required, the conduits must be staggered between tiers.
 - b. No more than two tiers or rows are permitted.
 4. All conduit wall stubs must be extended to and over the cable tray to access cable tray pathway.
 5. All rise conduit stubs must be provided with the proper universal drop-out/waterfall cable exit runway, which must be supported by and mounted to channel strut.
 6. Conduit crossovers are not permitted.
- Z. Riser conduit entrance in communications rooms – floor entry
 1. Riser conduits must enter the communications room floor 2 to 4 inches on center from the wall and must stub up 6 inches AFF.
 2. Conduit floor stubs must be spaced in increments to equal the conduit OD from each other.
 3. Riser conduits must be installed in a single tier or row from left to right horizontally.
 - a. If two tiers or rows are required, the conduits must be staggered between tiers.
 - b. No more than two tiers or rows are permitted.
 4. Exiting cable must be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.
 5. Conduit floor stubs must be extended 2 to 4 inches from wall on center and 3 inches above AFF.
 6. The riser cable must be extended in the cable tray to the terminating equipment, as noted in the Drawings.
 7. Conduit crossovers are not permitted.
- 3.4 MISCELLANEOUS PATHWAY DEVICES
 - A. Coordinate 4-inch core drill final locations with structural engineer.
 - B. Install poke-thru devices in accordance with manufacturer's instructions where indicated on floor plans.
- 3.5 TESTING
 - A. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. See NFPA 70B, Chapter 18, for testing and test methods.
 - B. Manufacturer must provide test reports witnessed by an independent testing laboratory of the "worst case" loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA VE-1; including test reports verifying rung load capacity in accordance with NEMA VE-1 Section 5.4.

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SECTION 270553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the labeling of communications infrastructure.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Patch Panel Labels
 - 2. Cable Labels
 - 3. Faceplate Labels
 - 4. Ground Tags

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. AWG American Wire Gauge
 - 3. BICSI Building Industry Consulting Service International
 - 4. CR Communications Room
 - 5. EF Equipment Field
 - 6. LV Low Voltage
 - 7. NECA National Electrical Contractors Association
 - 8. NEMA National Electric Manufacturers Association
 - 9. NFPA National Fire Protection Association
 - 10. OAR Owner's Authorized Representative
 - 11. RCDD Registered Communications Distribution Designer
 - 12. RFP Request for Proposal
 - 13. STD Standard
 - 14. TGB Telecommunications Grounding Busbar
 - 15. TIA Telecommunications Industry Association
 - 16. TMGB Telecommunications Main Ground Bus Bar
 - 17. TR Telecommunications Room
 - 18. UL Underwriters Laboratories
 - 19. UV Ultraviolet

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all BICSI and TIA recommended installation practices when installing communications labeling systems.
- D. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of Communications Cabling or Electrical Systems and that have five (5) years of installation experience with systems similar to that required for this project.

2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
 3. Provide verification that installation personnel responsible have been properly trained to install the products described in this Section.
 4. Provide a BICSI RCDD certified professional, or a master electrician, for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD or master electrician shall be a full time employee of the contractor.
 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2010
 2. ANSI/TIA-606-D – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2021
 3. NFPA 70 – National Electric Code
 4. BICSI – Telecommunications Distribution Methods Manual, 15th Edition
 5. Applicable codes and directives of authorities having jurisdiction
- G. Work:
1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
 2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
 3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
 4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- 1.4 CONFLICTS
- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.
- 1.5 PERMITS
- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.
- 1.6 SCHEDULING
- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.
- 1.7 REQUIREMENTS
- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.

- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Provide product data for the following:
 - 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 - 2. Proposed format of as-built documentation.

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 - 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 - 2. Provide above closeout documentation as an electronic file in PDF format.
- B. Warranty and Maintenance:
 - 1. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.
- B. Labels and markings shall be physically and chemically resistant to damage that would render the label unreadable.
- C. All labels shall be ANSI/TIA-606 compliant labeling products. All cables, faceplates, patch panels and terminations shall be labeled to ANSI/TIA-606 standards.

2.2 ADHESIVE COMPONENT LABELS

- A. Outlet Label - 2-Port Identifier
 - 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 - 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 - 3. Label shall be 1.25 inches (31.8 mm) wide, by 0.30 inch (7.6 mm) high.
 - 4. The label shall be white in color, with black machine-printed characters.
 - 5. Acceptable products:
 - a. Panduit
 - 1) C125X030FJC Network Label, P1 Cassette
 - 2) C125X030FJJ Network Label, Laser/Ink Jet
 - 3) C125X030YPT Network Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- B. Copper Patch Panel and Work Area Outlet Label, 4-Port
 - 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 - 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 - 3. Label shall be 2.52 inches (64.0 mm) wide, by 0.30 inch (7.6 mm) high.
 - 4. The label shall be white in color, with black machine-printed characters.
 - 5. Acceptable products:
 - a. Panduit
 - 1) C252X030FJC Component Label, P1 Cassette
 - 2) C252X030FJJ Component Label, Laser/Ink Jet
 - 3) C252X030YPT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- C. Copper Patch Panel Label, 6-Port
 - 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyolefin.
 - 2. Thermal transfer labels shall be constructed of die-cut, adhesive polyester.
 - 3. Label shall be 3.79 inches (96.3 mm) wide, by 0.30 inch (7.6 mm) high.
 - 4. The label shall be white in color, with black machine-printed characters.
 - 5. Acceptable products:
 - a. Panduit
 - 1) C379X030FJC Component Label, P1 Cassette
 - 2) C379X030FJJ Component Label, Laser/Ink Jet
 - 3) C379X030YPT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal
- D. Fiber Patch Panel Port Labels
 - 1. Ink/laser printed labels shall be constructed of die-cut, adhesive polyester, or black-on-white vinyl tape.
 - 2. Label shall be 3.50 inches (88.9 mm) wide, by 1.00 inch (25.4 mm) high.

3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
 - a. Panduit
 - 1) T100X100VPC-BK Component Label, P1 Cassette
 - 2) C350X100YJJ Component Label, Laser/Ink Jet
 - 3) C350X100YJT Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

2.3 ADHESIVE WIRE MARKER LABELS

A. Category 6/6A UTP Cable Labels

1. Label shall be constructed of self-laminating vinyl.
2. Label shall be 1.50 inches (38.1 mm) long, by 1.00 inch (25.4 mm) wide.
3. Label shall accommodate an outside diameter of 0.16 inch (4.0 mm) to 0.32 inch (8.1 mm).
4. The print-on area height shall be 0.50 inch (12.7 mm) and shall be white in color, with black machine-printed characters.
5. Acceptable products:
 - a. Panduit
 - 1) S100X150VAC Self-Laminating Label, P1 Cassette
 - 2) S100X150YAJ Self-Laminating Label, Laser/Ink Jet
 - 3) S100X150VAT Self-Laminating Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

2.4 NON-ADHESIVE LABELS

A. Outlet Label, 2-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 1.25 inches (31.8 mm) wide, by 0.40 inch (10.2 mm) high.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
 - a. Panduit
 - 1) C195X040Y1C Component Label, P1 Cassette
 - 2) C195X040Y1J Component Label, Laser/Ink Jet
 - 3) C195X040Y1T Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

B. Copper Patch Panel and Work Area Outlet Label, 4-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 2.61 inches (66.3 mm) wide, by 0.35 inch (8.9 mm) high.
3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
 - a. Panduit
 - 1) C261X035Y1C Component Label, P1 Cassette
 - 2) C261X035Y1J Component Label, Laser/Ink Jet
 - 3) C261X035Y1T Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

C. Copper Patch Panel Label, 6-Port

1. Label shall be constructed of die-cut, non-adhesive polyester.
2. Label shall be 3.90 inches (99.1 mm) wide x 0.30 inch (7.6 mm) high.

3. The label shall be white in color, with black machine-printed characters.
4. Acceptable products:
 - a. Panduit
 - 1) C390X030Y1C Component Label, P1 Cassette
 - 2) C390X030Y1J Component Label, Laser/Ink Jet
 - 3) C390X030Y1T Component Label, Thermal Transfer
 - b. Brady
 - c. HellermannTyton
 - d. Owner approved equal

PART 3 – EXECUTION

3.1 GENERAL

- A. Labeling shall be by mechanical means. Hand-lettered labels are not permitted unless otherwise noted.
 1. Utilize Panduit, or equivalent, labeler and software
- B. Tags shall be non-removable.
 1. Exceptions:
 - a. Faceplate labels that are placed in recessed label holders
 - b. Patch panel labels that are placed in recessed label holders
 - c. Telecommunications Ground tags secured with cable ties
 - d. Innerduct tags secured with cable ties
- C. Labels shall match hardware layout and design.
- D. Labels shall be as large as practicable while fitting properly.
- E. No lettering shall be smaller than 10-point.
- F. Labeling shall comply with the standards set forth in this document.

3.2 LABELING STANDARDS

- A. Room Identification
 1. Label Communications Backboard or Equipment Rack closest to entry door with unique identifying code.
 2. Lettering shall be a minimum of one inch high.
- B. Patch Panel and Port Labeling
 1. Patch panel ports are numbered from left to right, top to bottom starting with '01' to '24', then '25' to '48', then '49' to '72', etc.
 2. The data port label shall indicate the patch panel port number.
 - a. Example: 097
- C. Telecommunications Outlet Identification
 1. Position labels in recessed label holders on faceplate and cover with plastic covers.
 2. Telecommunications Outlet Faceplate labeling code shall be as follows:
 - a. WAO Jack ID
 - 1) Destination Patch Panel Port # (e.g. YYY).
 - 2) Patch panel ports are numbered from left to right, top to bottom starting with '01' to '24', then '25' to '48', then '49' to '72', etc.
- D. Horizontal Cabling
 1. All horizontal cables shall be labeled at Telecommunications outlet and horizontal cross-connect with self-laminating labels via Panduit labeler and software.
 2. Cables shall be labeled at each end with information indicating termination point of both ends of cable as follows:
 - a. Patch Panel Port #
 - 1) Example: 097
 3. Cables shall be labeled on a visible part of the cable within three to six (3-6) inches of termination point for ease of identification after termination.

4. Labels at the telecommunications outlet shall be visible by removing the faceplate.
 5. Rooms with multiple outlet locations shall be numbered sequentially beginning clockwise from the first outlet to the left of the main entrance to the room.
- E. Telecommunications Grounds
1. Label Grounds on a visible part of the ground cable within twelve (12) inches of termination point for ease of identification after termination.
 2. Tags shall be secured to ground cable using self-locking ties

END OF SECTION

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SECTION 271500

COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, and equipment for the complete installation of Work called for in the Contract Documents.
- B. This section includes the minimum requirements for the installation of horizontal cabling between Telecommunications Rooms and Work Area Outlets.
- C. Included in this section are the minimum composition requirements and installation methods for the following:
 - 1. Copper Cable & Accessories
 - 2. Work Area Outlet Products
 - 3. Miscellaneous Products

1.2 DEFINITIONS AND TERMS

- A. Trade association names and communications terminology are frequently abbreviated. The following acronyms or abbreviations may be referenced within this Section:
 - 1. ANSI American National Standards Institute
 - 2. AWG American Wire Gauge
 - 3. BICSI Building Industry Consulting Service International
 - 4. CMR Communications Riser Cable
 - 5. CMP Communications Plenum Cable
 - 6. CR Communications Room
 - 7. FEP Fluorinated Ethylene Propylene
 - 8. FOCIS Fiber Optic Connector Intermateability Standards
 - 9. F/UTP Foil Shielded Twisted pair
 - 10. IDC Insulation Displacement Connector
 - 11. IEC International Electrotechnical Commission
 - 12. IEEE Institute of Electrical and Electronics Engineers
 - 13. ISO International Standards Organization
 - 14. MCR Main Communications Room
 - 15. MDF Main Distribution Frame
 - 16. NEMA National Electric Manufacturers Association
 - 17. NEXT Near End Crosstalk
 - 18. NFPA National Fire Protection Association
 - 19. OAR Owner's Authorized Representative
 - 20. OFCP Optical Fiber Conductive Plenum
 - 21. OFCR Optical Fiber Conductive Riser
 - 22. OFNP Optical Fiber Nonconductive Plenum
 - 23. OFNR Optical Fiber Nonconductive Riser
 - 24. OLTS Optical Loss Test Set
 - 25. OTDR Optical Time Domain Reflectometer
 - 26. PCI Panduit Certified Installer
 - 27. RCDD Registered Communications Distribution Designer
 - 28. RFP Request for Proposal
 - 29. RL Return Loss
 - 30. STD Standard
 - 31. STP Shielded Twisted Pair
 - 32. TIA Telecommunications Industry Association
 - 33. UL Underwriters Laboratories
 - 34. UTP Unshielded Twisted Pair

1.3 QUALITY ASSURANCE

- A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the OAR.
- B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the OAR.
- C. Strictly adhere to all TIA and BICSI recommended installation practices when installing communications cabling.
- D. Contractor's Qualifications:
 - 1. Firms regularly engaged in the installation of Data Communications cabling and that have five (5) years of installation experience with systems similar to that required for this project.
 - 2. Provide references to include client names, phone numbers and a summary of project details. These references will be checked, and the clients will be asked questions relative to the performance of your company.
 - 3. Provide verification that installation personnel responsible have been properly trained to install the products and offer manufacturer's extended warranty as described in this Section.
 - 4. Provide a BICSI RCDD certified professional for oversight on this project. This person does not have to be working on-site but must be accessible to answer questions and provide weekly status reports. The RCDD shall be a full-time employee of the contractor.
 - 5. Provide full time project manager with a minimum of ten (10) years field experience in installation of communications systems and infrastructures. Project manager shall be assigned for the duration of the project and shall not be replaced without written consent from the OAR.
- E. Manufacturer's Qualifications:
 - 1. Firms regularly engaged in manufacture of products of the types, ratings and capacities required for this project; whose products have been in satisfactory use in similar service for not less than five (5) years, with production capabilities per applicable NEMA standards.
- F. Material and Work specified herein shall comply with the applicable requirements of:
 - 1. NECA 1 – Standard Practice of Good Workmanship in Electrical Construction, 2015
 - 2. ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunications Cabling, 2006
 - 3. ANSI/TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises, 2020
 - 4. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard, 2020
 - 5. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standards, 2018
 - 6. ANSI/TIA-568.3-D – Optical Fiber Cabling Components Standard, 2016
 - 7. ANSI/TIA-568.3-D-1 – Optical Fiber Cabling and Components Standard - Addendum 1: General Updates, 2019
 - 8. ANSI/TIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces, 2019
 - 9. ANSI/TIA-606-D – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2021
 - 10. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, 2019
 - 11. ANSI/TIA-526.7-A – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, 2015
 - 12. ANSI/TIA-526.14-C – Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant, 2015
 - 13. ANSI/TIA-942-B – Telecommunications Infrastructure Standard for Data Centers, 2017
 - 14. NFPA 70 – National Electric Code
 - 15. UL 13 – Standard for Safety for Power-Limited Circuit Cables
 - 16. UL 444 – Standard for Safety for Communications Cables
 - 17. BICSI – Telecommunications Distribution Methods Manual, 15th Edition
 - 18. BICSI – Information Technology Systems Installation Methods Manual, 8th Edition
 - 19. IEEE 802 – Local Area Network Standard
 - 20. Applicable codes and directives of authorities having jurisdiction
- G. Work:

1. The Work shall be performed in compliance with the applicable manufacturer's installation instructions, Standards, and certifications listed herein, the Contract Documents, and governing codes and regulations of the authorities having jurisdiction.
2. The drawing and specification requirements govern where they exceed Code and Regulation requirements.
3. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
4. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.

1.4 CONFLICTS

- A. This installation shall be made in strict accordance with the Specifications, Drawings, any applicable codes, referenced publications and standards. In case of conflicts between the aforementioned, notify the OAR in writing prior to commencement of affected work.

1.5 PERMITS

- A. The Contractor shall secure and pay for all necessary permits and fees required for the execution of this Work. Work will not start until all permit applications are approved.

1.6 SCHEDULING

- A. The Contractor shall comply with all scheduling requests established by OAR, both prior to commencing Work, and during construction. The Contractor shall provide a detailed schedule of work to be performed. This schedule shall be submitted with the bid and, if accepted, will be used to track work status.
- B. Work should be scheduled not to interfere with day-to-day operations within the facility. Operations vary by area and should be given careful consideration in relation to the schedule.
- C. The successful Contractor for all or any portion of the work described by this RFP package will be responsible for achieving a complete and fully functional installation on or before the contract scheduled completion date.

1.7 REQUIREMENTS

- A. All references to manufacturers, model numbers and other pertinent information herein are intended to establish standards of performance and quality of construction. The OAR must approve material submittal and substitutions in writing.
- B. Verification that all the components specified and installed meet the criteria specified by the respective component manufacturer, supplier and designer is the responsibility of the Contractor.
- C. All installation tools, special equipment and testing apparatus required to accomplish field connections and related work as described herein shall be furnished by the Contractor at no additional cost.
- D. The requirements as given in this document are to be adhered to unless revised by the OAR in writing.
- E. The Owner reserves the right to waive these requirements at any time.

1.8 SUBMITTALS

- A. Comply with provisions of Division 01.
- B. Comply with provisions of Section 27 05 00.
- C. Produce Shop Drawings for ALL horizontal cabling, to include but not limited to, proposed routing and its location relative to building structure (columns, floor or ceiling) and its relationship to electrical, mechanical elements as well as any horizontal copper cables that may exceed 295' in length (including service loops).
- D. Provide all submittal requirements under this section as a single package.
- E. Contractor shall not utilize the Consultants' original design drawings in the submittal or shop drawing process. Contractor shall develop their own original shop drawings.
- F. Provide product data for the following:
 1. Product data consisting of manufacturers specifications for each type of product to be installed, all applicable certifications and elevation/plan documents supporting compliance with stated Specifications.
 2. Manufacturer's certificate of acceptance of the qualifications of the installing Contractor to install, test and maintain the manufacturer's equipment.

3. Manufacturer's installation specifications for UTP cabling and optical fiber, indicating minimum bend radius and maximum pull tension.
4. Outline of administration labeling scheme for voice and data communications cabling and termination locations per Section 27 05 53, as well as the latest releases of ANSI/TIA-606.
5. Proposed format of as-built documentation

1.9 CONTRACTOR CLOSE OUT SUBMITTALS

- A. Submit Closeout documentation in accordance with Division 01 of the Project Manual and any applicable supplements. The number of submittal sets required is the greater of either the requirements of Division 01 of the Project Manual, or a minimum of four (4) sets.
 1. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues.
 2. Test reports on all copper and optical fiber cables (electronic file format and hard copy).
 3. As-built cable schedules with recorded cable routing and lengths of each designated run.
 4. As built documentation of all cabling systems.
 5. As built documentation of MDF/CR/IDF modifications and associated cabinet elevations.
 6. Laminated as-built drawing sheet of CR/IDF service area representing each level, with a scale of not less than 1/8", mounted on the wall of each CR/IDF.
- B. Warranty and Maintenance:
 1. Test Report Binder(s)
 2. Record Drawings

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials factory-packaged in containers or reels and handle in accordance with manufacturer's recommendations. Store in a clean, dry space and protect products from damaging fumes and traffic. Handle materials carefully to avoid damage.
- B. Storage space on project site may be limited. Contractor shall coordinate delivery and arrange storage of materials and equipment with the OAR.
- C. Components sensitive to damage in a harsh environment shall be stored off-site and delivered as needed.
- D. Provide protective covering during construction to prevent damage or entrance of foreign matter.
- E. Contractor is responsible for on-site security of tools, test equipment and materials.
- F. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.11 PROJECT CONDITIONS

- A. Verify conditions on the job site are applicable to this Work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install Work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the Work may be installed.

1.12 WARRANTY

- A. Warrant labor and product to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics, following Contractor Warranty requirements defined in Division 01. Repair or replace defects occurring in labor or product within the Warranty period without charge.
- B. All surplus parts and pieces to the installation shall be maintained as a spare parts inventory at the building site. Parts replaced during the warranty period shall have a warranty matching that of the original part from date of replacement.
- C. In addition to the warranty outlined above, the Contractor shall facilitate an extended warranty between the Owner and the Manufacturer that provides coverage of the installed cabling system for a period of no less than (25) twenty-five years (Panduit Certification Plus System Warranty). This warranty will cover the installed horizontal cabling system (Patch Panel to Workstation). Horizontal copper and fiber links shall be warranted against the link performance minimum expected results defined in the latest issuance of ANSI/TIA-568. Installation shall be performed by a Panduit Certified Installer.

1.13 ADD-ALTERNATE PRICING

- A. Contractor shall provide additional price for add/alternate cost of the following items:
 - 1. Two (2) Cat6 cables per Wireless Access Point (WAP) in lieu of the one (1) Cat6 cable indicated in the drawing set.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The products specified in this document do not necessarily constitute the exhaustive list of products required to complete the statement of work. Except where described in the SUMMARY subpart of this document, the contractor is responsible for providing any other parts and materials needed to deliver a complete and working system.

2.2 ACCEPTABLE DISTRIBUTORS

- A. Subject to compliance with requirements set forth in these construction documents, Contractor shall procure all horizontal cabling components through an approved Panduit distributor.

2.3 ACCEPTABLE VENDORS AND MATERIALS

- A. Subject to compliance with requirements, install products from the following manufacturers, except where noted:
 - 1. Cable, Copper & Optical Fiber
 - a. Panduit Corp.
 - b. Owner Approved Equivalent
 - 2. Termination Components
 - a. Panduit Corp.
 - b. Owner Approved Equivalent
- B. Part numbers are provided for convenience purposes only; the contractor is responsible for complete material list and quantities. All materials listed are manufactured by Panduit Corporation unless otherwise noted. Colors shall be approved by Owner.

2.4 COPPER CABLE AND ACCESSORIES

- A. Category 6A UTP Cable
 - 1. Provide Category 6A cabling, where indicated on drawings.
 - 2. Cable shall exceed ANSI/TIA-568-D and ISO/IEC 11801 Class E_A standards.
 - 3. The conductors shall be 23 AWG construction with FEP (CMP) insulation.
 - 4. The copper conductors shall be twisted in pairs, separated by an integrated pair divider and shall be covered by a low smoke, flame retardant (CMP) jacket.
 - 5. Provide plenum-rated cable for all plenum environments.
 - 6. Cable shall include an LP Rating of .7A.
 - 7. The jacket colors shall be as follows:
 - a. Blue for Wireless Access Points
 - b. Blue for Phone, Computer, Timeclock, Printer/Fax, etc.
 - c. Orange for Security Devices (Cameras, Intercoms, Alarm, etc)
 - 8. Approved products (where xx = color):
 - a. Panduit: PUP6AHD04xx-G
 - b. Owner approved equivalent
- B. Category 6A UTP Jack Modules
 - 1. Provide Category 6A jack modules to terminate both ends of each Category 6A horizontal cable.
 - 2. Module shall exceed requirements of ANSI/TIA-568-D.2 Category 6A, ISO 11801 Class E_A channel standards and exceed requirements of ANSI/TIA-568-D.2 Category 6A and IEC 61156-5 Category 6A component standards.
 - 3. Module shall meet requirements of IEEE 802.3af / 802.3at, and proposed IEEE 802.3bt type 3 and 4 for Power over Ethernet (PoE) applications.
 - 4. Module shall be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
 - 5. Modules shall be:
 - a. White (WH) for Wireless Access Points

- b. White (WH) for Phone, Computer, Timeclock, Printer/Fax, etc.
 - c. Orange (OR) for Security Devices (Cameras, Intercoms, etc)
 - 6. Modules in MER/TR patch panels shall match the color of jack at the faceplate.
 - 7. Approved products (where "xx" = color):
 - a. Panduit: CJ6X88TGxx
 - b. Owner Approved Equivalent
- C. Category 6A Copper Patch Cords within Communications Rooms
 - 1. Provide Category 6A patch cords for patching Category 6A outlets within TRs.
 - 2. Patch cord shall meet or exceed ANSI/TIA-586-D.2 Category 6A and ISO 1180 Class E_A specifications.
 - 3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
 - 4. Each patch cord shall be 100% performance tested and wired T568A.
 - 5. Patch cord shall be constructed of solid cordage, with modular plugs.
 - 6. Patch cord plugs shall meet all applicable ANSI/TIA-968-A requirements and exceeds IEC 60603-7 specifications.
 - 7. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
 - 8. Include a quantity of different length cords (3', 5', 7', and 10') for 100% of all installed cables.
 - 9. Patch cord color shall be:
 - a. Yellow for Wireless Access Points
 - b. Yellow for Phone, Computer, Timeclock, Printer/Fax, etc.
 - c. Red for Temporary IT Patch Cords (coordinate the use of temporary cords with Owner)
 - d. Orange for Security Devices (Cameras, Intercoms, etc)
 - 10. Contractor MUST coordinate the quantity of each length and color with Owner prior to purchase.
 - 11. Approved products (Replace the "***" with the color code):
 - a. Panduit: UTP28X3*
 - b. Panduit: UTP28X5*
 - c. Panduit: UTP28X7*
 - d. Panduit: UTP28X10*
 - e. Owner approved equivalent
- D. Category 6A Copper Patch Cords for Work Area Outlets (WAO)
 - 1. Provide Category 6A patch cords for Category 6A work area outlets.
 - 2. Patch cord shall exceed ANSI/TIA-568-D.2 Category 6A and ISO 11801 Class E_A standards.
 - 3. Shall meet requirements of IEEE 802.af and IEEE 802.3at for PoE applications.
 - 4. Each patch cord shall be 100% performance tested and wired T568A.
 - 5. Patch cord shall be constructed of Category 6A, 24 AWG UTP stranded cable and Category 6A Modular Plugs; plug contacts plated with 50 micro-inches of gold for superior performance.
 - 6. Patch cord plugs shall meet all applicable ANSI/TIA-968-A requirements and exceeds IEC 60603-7 specifications.
 - 7. Plugs shall use an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug.
 - 8. Patch cord shall perform in center of TIA component range, ensuring interoperability and excellent performance.
 - 9. Patch cord shall be labeled with an identification of performance level, length, and a quality control number.
 - 10. Provide a quantity of 7', 10' and 15' length patch cords for every port on every work area outlet.
 - 11. Provide plenum rated patch cords for work area outlets installed above the ceiling and not patched inside of a raceway (i.e. the patch cord is exposed inside the plenum). These scenarios include, but are not limited to:
 - a. Wireless Access Points
 - 12. Patch cord color shall be:
 - a. Yellow for Wireless Access Points
 - b. Yellow for Phone, Computer, Timeclock, Printer/Fax, etc.
 - c. Red for Temporary IT Patch Cords (coordinate the use of temporary cords with Owner)
 - d. Orange for Security Devices (Cameras, Intercoms, etc)
 - 13. Contractor MUST coordinate the quantity of each length and color with Owner prior to purchase.
 - 14. Approved products (Replace the "***" with the color code):

- a. Panduit: UTP6AX7*
- b. Panduit: UTP6AX10*
- c. Panduit: UTP6AX15*
- d. Owner approved equivalent

2.5 WORK AREA OUTLET PRODUCTS

A. Wall Mount Faceplates

- 1. Provide wall mount faceplates for voice and data work area outlets.
- 2. Faceplate shall accept four (4) or six (6) Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- 3. Include label/label covers for easy port identification.
- 4. Raised rail design for aesthetic appeal.
- 5. Faceplate color shall be White (WH), and coordinated with the architect during the product submittal process.
- 6. Approved products (where xx = color):
 - a. Panduit CFPE4xxY Mini-Com® Executive Series Faceplate, 4-Port.
 - b. Owner approved equivalent.
 - c.

B. Surface Mount Outlet Box

- 1. Provide surface mount outlet boxes for work area outlet locations where outlets cannot be recessed.
- 2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- 3. Mount easily with supplied mounting screws, adhesive tape or optional magnet.
- 4. Cable entry from side and rear knockouts and from opening in center of base.
- 5. Outlet box color shall be White (WH), and coordinated with the architect during the product submittal process.
- 6. Approved products (where xx = color):
 - a. Panduit CBX1xx-A Surface Mount Box, 1 Port
 - b. Panduit CBX2xx-AY Surface Mount Box, 2 Port
 - c. Panduit CBX4xx-AY Surface Mount Box, 4 Port
 - d. Owner approved equivalent.

C. Furniture Faceplate

- 1. Provide faceplates for work area outlet locations inside of modular furniture.
- 2. Shall accept Mini-Com® Modules for STP and UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- 3. Coordinate the exact faceplate assembly with the furniture manufacturer.
- 4. Faceplate shall be black in color.
- 5. Approved products:
 - a. Panduit Mini-Com® Modular Furniture Faceplate, 4 Port
 - b. Owner approved equivalent.

D. Blank Modules

- 1. Populate any unused faceplate module openings with blank modules.
- 2. Populate any unused patch panel module openings with blank modules.
- 3. Black module colors shall be:
 - a. White (WH) where installed in White outlet faceplates or surface mount boxes
 - b. Black (BL) where installed in patch panels
- 4. Approved products (where xx = color):
 - a. Panduit CMBxx-X Mini-Com® Blank Module
 - b. Owner approved equivalent.

E. Angled Patch Panels

- 1. Provide modular angled patch panels in IT Room for all horizontal UTP cabling.
- 2. Patch panel shall accept Mini-Com® Modules for UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes.
- 3. Use of two label pocket faceplates allowing both port and panel identification.
- 4. Can be clearly identified with the Hand-Held Thermal Transfer Printers.

5. Use 72-port "high-density" patch panels in a 2U size.
6. Approved products:
 - a. Panduit CPPLA72WBLY Angled Patch Panel, 72 Port, with labels, Black
 - b. Owner approved equivalent

2.6 MISCELLANEOUS PRODUCTS

A. Cable Ties

1. Provide "hook & loop" cable ties for bundling cables.
2. The material shall consist of nylon loops with polypropylene hooks.
3. Use plenum-rated ties in plenum spaces.
4. Approved products:
 - a. Panduit TTS-20R0 Hook & Loop Roll, Low Profile, 20'L, .75"W, Black
 - b. Panduit HLSP*S-X0 Hook & Loop Cable Tie, Plenum
 - c. Owner approved equivalent.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify conduit, raceways, boxes, fittings and bodies are properly installed as described in Division 26.
- B. Verify grounding and bonding following Section 270526.
- C. Verify supporting devices are properly installed following Section 270528.
- D. Verify conduit has a minimum 1-inch diameter for UTP or F/UTP home runs.
- E. All protected telecommunication terminations require bonding, grounding and a busbar.

3.2 INSTALLATION

A. General

1. Cables shall be pulled in accordance with the manufacturers recommended practices and in compliance with the NEC and the BICSI Telecommunications Distribution Methods Manual. Planning and care shall be taken to prevent abuse and damage during the handling or installation phase. Specified minimum cable bend radius shall be met without deviation.
2. Pull cables simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant where necessary. Compound used must not deteriorate conductor or insulation. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.
3. Protect cable from tension, compression, torsion, bending, squeezing and vibration. Do not pull cables improperly or exceed the Manufacturer's tensile rating. This value shall be not more than thirty-two (32) lbf. force (provide breakable link for all cable pulling). There shall be no coils of excess cable left in the ceilings, cable trays, or raised floor areas unless specified otherwise. A trailer pull string shall be left in all conduits before and after cables have been installed. The cabling within the wiring closets/cabinets shall be routed and dressed neatly to their termination points such that no excess cable is present. As cables are pulled into the cabinet, bundle them in groups with Velcro type straps according to their terminating row position. Strap exposed cables for strain relief at the termination in the communications rooms.
4. All strapping and lashing of cable within the CR(s) and IDF(s) shall be made with "Velcro" type straps for easy access to cable bundles to facilitate future "adds and changes". No plastic tie-wraps will be allowed for support of cable.
5. All cabling will be rated for a minimum operation range of -20°C to 75°C
6. All floor and wall penetrations shall be fire-stopped in accordance with local codes and restrictions.
7. New cabling will be installed in cable tray, conduit, and/or J-hooks (where allowed) throughout entirety of cable path.

B. Horizontal Cable

1. Install voice and data cable locations and configurations as depicted on drawings.
2. Test all cable prior to installation. Upon failure to perform testing, the installer shall accept the cable as good and assume all liability for the replacement of the cable should it be found defective at a later date.
3. All conformance standards must be certified for multipair and individual cable runs.

4. Jacketing and insulation must satisfy the Underwriter's Laboratories (UL) listed fire rated cable insulation requirements in plenum areas.
5. Any pulling compound or lubricant used in cable installation must not deteriorate the conductor or the insulation. Provide 3M type WLC or an approved equal.
6. Copper cable runs shall not exceed 295 feet. All runs shall be continuous. No splicing is allowed.
7. The Contractor shall install copper cable with a minimum bend radius of six times the diameter of the cable.
8. Provide a 10-foot, patch cable with RJ-45 connectors for 50% of each work area outlet insert installed, unless noted otherwise. Provide a combination of 5, 7 and 10-foot patch cords for each termination in the CR/IDF rooms, unless noted otherwise. The patch cable rating and connector shall match the horizontal cable/connector rating.
9. Install 10-feet of spare copper cable (service loop) in each closet prior to termination. Provide Velcro straps for cable support and organization.
10. Install minimum 12-inches of spare copper cable in ceiling plenum prior to dropping down wall to outlet. Support slack to structure with J-Hook (where allowed) and Velcro ties. If there is no plenum, loop shall be located in box prior to termination. Provide box of sufficient size to accommodate spare cable, termination equipment if applicable and maintain required bend radius.
11. Install 10-feet of spare copper cable (service loop) at each above ceiling outlet prior to termination. Provide Velcro straps for cable support and organization.
12. All horizontal cable shall be rated for plenum use, unless noted otherwise.
13. The maximum pulling tension for 4-pair 23 AWG horizontal UTP and F/UTP cables shall not exceed 32 lbf. The Contractor shall provide a tension meter during the pulling of all cables. If the meter shows that the tension has exceeded 32 lbf, the Contractor shall discard the cable and pull new cable at no additional cost to the Owner.

3.3 WORKSTATION TERMINATION

- A. At the workstation termination point, cables shall be routed and dressed to provide a service loop in case re-termination is necessary. Leave 12 inches of slack at the junction box. Provide strapping of voice and data cable to provide strain relief of cable in relation to outlet termination.
- B. Each horizontal workstation cable shall terminate on a "Mini-Com" modular jack connector and attached to the outlet faceplate. All unused faceplate ports will have a blank insert.
- C. The Contractor shall adhere to the latest termination procedures as specified by manufacturer's instructions.
- D. Coordinate with Owner to confirm the required TIA T568 termination pin-out procedures.

3.4 PATCH SYSTEM

- A. Each horizontal data cable will terminate on a "Mini-Com" modular jack, inserted into the patch panel module. Horizontal termination of individual data cables within the communications room shall be the same as aforementioned termination procedures for the workstation cables.
- B. Mount the distribution panels starting at the upper most position of the racks/rails beginning with contractor provided fiber patch panels. Allow for sufficient space between the distribution panels to allow for horizontal wire managers and cross connect component installation. Provide a detail of your elevation plan to the OWNER or Owner's Representative before proceeding.
- C. Patch cables shall be provided and installed as noted within Part 2 of this section and as noted in the drawing set. Ten-foot cables used for WAO and five/seven/ten foot cables for rack patching, unless noted otherwise.
- D. Small diameter patch cords, which are installed in the IT spaces (Communications Room/Telecommunications Rooms/IT Rooms) shall installed in a manner as to limit the bundling of patch cords to no more than 24 patch cords.

3.5 LABELING

- A. Comply with Section 270553 - Identification for Communications Systems.

3.6 TESTING

- A. General Requirements:
 1. Provide a minimum of 72 hours' notice to the OAR prior to testing. All testing may be witnessed by OAR, at OAR's discretion.
 2. Follow recommended procedures for testing as published by test equipment manufacturer.

3. Test equipment shall be calibrated within the last 12 months prior to the date of testing, or within a period of time recommended by the test equipment manufacturer. Test results shall include calibration documentation.
 4. Contractor shall test each pair or strand of every cable prior to acceptance, with 100% Passing results.
 5. Contractor shall supply all of the required test equipment and personnel certified by the equipment manufacturer to perform acceptance tests.
 6. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.
 7. Test results saved within the field-test instrument shall be transferred into a Windows™ based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., "as saved in the field-test instrument". The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
 8. Standards Compliance and Test Requirements:
 - a. Horizontal copper shall exceed requirements as defined within the latest release of ANSI/TIA-568.2-D Copper Cabling Components and meet the manufacturer's specifications for the installed product.
 - b. Horizontal optical fiber shall exceed requirements as defined within the latest release of ANSI/TIA-568.3-D Optical Fiber Cabling Components Standard and meet the manufacturer's specifications for the installed product.
- B. Copper Media Testing:
1. Contractor shall utilize personnel trained in the operation of the test equipment, which shall provide a minimum Level III accuracy:
 - a. Fluke DSX-5000 Series
 - b. Ideal LanTEK Series
 - c. VIAVI Certifier Series
 - d. Or approved equal
 2. All cables and termination hardware shall be 100% tested for defects in installation and to verify permanent link performance under installed conditions. The Contractor prior to system acceptance shall verify all conductors of each cable useable. Any defect in the cable system installation including but not limited to cable, connectors, patch panels and connector blocks shall be repaired or replaced at no additional cost to the Owner, to ensure 100% useable conductors in all cables installed.
 3. Perform end to end link testing of all cabling and connections with specified equipment and certify as meeting the criteria as defined within the latest publication of ANSI/TIA-568.2
 4. Provide equipment calibration reports with test results.
 5. Provide 72 hours' notice to the OAR prior to testing.
 - 6.
- C. Optical Fiber Media Testing:
1. Contractor shall utilize personnel trained in the operation of the test equipment. Test equipment shall comply with ANSI/TIA-526-7-A and ANSI/TIA-526-14-C.
 - a. Fluke Networks
 - b. Exfo Inc.
 - c. Or approved equal
 2. Contractor shall perform end to end testing of all installed fiber strands and connections with specified equipment, and certify all strands as meeting the criteria as defined within the latest publication of ANSI/TIA-568.3
 3. OLTS Reports: Testing shall consist of a bi-directional, dual wavelength end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.
 4. OTDR Reports: Testing shall consist of a bi-directional end to end OTDR trace performed per TIA-455-78-C.
 5. A testing loss budget shall, at a minimum, incorporate the following loss budgets, unless noted otherwise.
 - a. Reflective events (connections) shall not exceed 0.75 dB.
 - b. Non-reflective events (splices) shall not exceed 0.3 dB.

- c. A fusion-spliced connector or pigtail shall not exceed the manufacturer-specified maximum insertion loss. Therefore, the optical loss budget for a fusion-spliced connector or pigtail shall not be 1.05 dB (0.75dB + .3dB) unless that is the published maximum insertion loss by the manufacturer.
 - 6. Testing of the cabling shall be performed using high-quality test cords (not patch cords) of the same fiber type as the cabling under test, as recommended by the equipment manufacturer. The test cords for OLTS testing shall be between one meter and five meters in length. The test cords for OTDR testing shall be approximately 100 meters for the launch cable and at least 25 meters for the receive cable.
- 3.7 CLEANING
- A. Upon completion of the installation, make all components free of any oil, grease, dust and debris.
 - B. Work areas will be cleaned at the end of each workday and a final cleanup will occur at project completion.
- 3.8 DOCUMENTATION
- A. Electronic submittal, via CD ROM, of required cable test results, As-Built drawings, and warranty information will be submitted to the Owner or Owner's representative at least ten (10) working days before Certificate of Occupancy is awarded. CAD files will be submitted in Micro Station (.dgn) or Autocad (.dwg) format. When proprietary software is needed to view cable test results, the contractor will provide a licensed copy for the owner's use. The Contractor is responsible for providing the installed wiring infrastructure data on a CD in native and PDF file formats.
- 3.9 ACCEPTANCE
- A. Review test results and conduct a final inspection and punch list walk-thru with Owner and/or OAR, to inspect installation and obtain concurrence. Concurrence does not waive the responsibility of the Contractor to correct deficiencies.

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SECTION 281000

ELECTRONIC SECURITY SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The scope of work shall include furnishing all labor, materials, enclosures, wiring, equipment, programming, training, testing, documentation and warranty support, required to provide a completely operational and working Security System.
- B. All materials for the structured cabling system (4-pair UTP cables, fiber optic cables and 24-AWG multi-pair (25 pairs or higher) components required for the security system shall be in compliance with specification Section 271500. Orange cable color shall be used to identify security cabling.
- C. The Security System Installer (SSI) shall coordinate with the door frame installer, the door installer, the door hardware installer on the placement of all electronic locking hardware and door controls for this project. The SSI shall provide the low voltage power supplies for all electric locks, wire and cable, terminate all connections, and shall interface this equipment with the integrated security system.
- D. The scope of work for this specification shall also include the following items:
 - 1. The programming of the access control software including the integration described in this specification, and interface to the existing headend.
 - 2. The supply, installation, and programming of the Intrusion Alarm system.
 - 3. The supply, installation, and programming of the site Emergency Assistance stations.
- E. The following parts of the system are not part of this section:
 - 1. All networking equipment (switches, routers, etc) for the operation of the system. The security contractor shall coordinate their network connection requirements with the clients IT department to ensure all necessary connections are provided where required, and in the quantity that is necessary. Ensure PoE needs are clearly identified during this coordination effort. If switches do not provide PoE injectors must be provided to support the equipment.
 - a. Exception: Industrial PoE network switches and media converters to support site security assistance stations and cctv systems. This equipment is to be provided under this scope of work and basis of design is referenced on the plans.
 - 2. All computers and software to run the security headend systems with the exception of the items indicated in this specification.

1.2 RELATED DOCUMENTS

- A. General Terms and Conditions of the Contract Documents
 - 1. Division 8 – Door Hardware
 - 2. Division 26 – Electrical
- B. Supplemental: Refer to the specification sections identified below for additional requirements, which are supplemented by this section.
 - 1. 270500 Technology General Provisions
 - 2. 270526 Grounding and Bonding for Communication Systems
 - 3. 270528 Raceways for Technology
 - 4. 271500 Structured Cabling System
 - 5. 282000 Video Surveillance System

1.3 SECURITY SYSTEM INSTALLER QUALIFICATIONS

- A. The Security System Installer (SSI) selected for this project must be a direct manufacturer authorized representative of the product they propose to provide. All technicians assigned to install and configure this system shall be factory trained and certified for the proper installation of this equipment. The SSI must have a minimum of 5 qualified and factory trained technicians to support this system. This company must be of established reputation and experience, regularly engaged in the supply and support of such systems for a period of at least five consecutive years. This company shall have a fully staffed office of sales and technical support representatives within 100 miles of travel to this project.

- B. The system programmer shall have attended manufacturer training and obtained certification on systems specified herein.
- C. Other required SSI qualifications are:
 - 1. The SSI shall agree, in writing, as part of their proposal, to provide both warranty and non-warranty service within 4 hours of notification of a problem. The SSI shall be able to perform any and all repairs to the system within 24 hours.
 - 2. The SSI shall submit as part of the qualifications required, the resume of the programmers for the access system as well as the training certificates for this staff from the manufacturer of the system.

1.4 MATERIALS ALTERNATES AND SUBSTITUTIONS

- A. General: See details for alternates and substitution in specification section 270500.
- B. Due to compatibility issues with other buildings under the control of the owner, the only approved Access Control System for this project is the Apollo Intelligent Security Solution and Honeywell Vista Intrusion Alarm System. No substitutions will be considered for this system.
- C. Sensors or door security devices, with the exception of card readers, shall allow substitutions.

1.5 SHOP DRAWINGS AND SUBMITTALS

- A. The SSI shall follow all requirements for shop drawings indicated in specification section 270500.
- B. The submittal process for this scope of work will be a two-stage process. The first stage is the product/installer approval. Within 30 business days of receiving contract approval and notice to proceed, the following items shall be submitted to the Owner, Architect, Engineer, or other designated representatives, for review and approval.
 - 1. Proof of Installer qualifications, addressing all requirements of paragraph 1.3 of this specification.
 - 2. Product numbers, specifications, and data sheets for all equipment.
 - 3. Data sheets and samples of all labeling materials and equipment to be used in the project.
 - 4. A complete explanation of the identification method to be used for all equipment and cabling part of the security system.
 - 5. Data sheets of all termination blocks and mounting accessories to be used in the project. A paragraph shall be added before each data sheet indicating the intended use of each type of termination block.
 - 6. Detailed drawings of all custom products to be used in the project.
 - 7. Data sheets for all wire and cable to be used as part of this system. A paragraph shall be added before each data sheet indicating the intended use (to connect what type of devices) of each cable.
- C. The second stage of the submittal process is the shop drawing process. Shop drawings shall only be submitted after all portions of the product/installer approval have been accepted by the Owner, Architect, Engineer, or other designated representatives. The following information is required as part of the shop drawings:
 - 1. Floor plans indication all devices to be provided and all cable runs to all devices or junction boxes. Devices for alarm systems shall indicate the zone numbers. Access controlled doors shall have the door name. All other devices shall have a unique identifier, as they will be programmed in the system.
 - 2. Point to point wiring diagrams indicating all termination points for each conductor and for each device, cable types and color coding of each termination. These diagrams shall be submitted for each door type and for each type of device in the system.
 - 3. Panel schedules in a table format, indicating all ports being used and what device is connected to each port. Panel schedules shall be submitted for all access control panels, alarm panels, fiber optics distribution frames, Ethernet switches, patch panels, termination blocks, etc.
 - 4. Overall system diagrams indicating all head end components, their room location, and all configuration characteristics like IP addresses, serial ports used, etc.
 - 5. Termination details for multi-conductor connectors and other details not included in item 2 of the shop drawings.
 - 6. Outline of the testing process.
 - 7. Training syllabus for all systems included in this scope.

1.6 ABBREVIATIONS

- A. Additional abbreviations used in this document:
 - 1. ACS - Access Control System
 - 2. ADA - Americans with Disabilities Act

3. API - Application Programming Interface
4. ASCII - American Standard Code for Information Interchange
5. BPS - Bits Per Second
6. CCTV - Closed Circuit Television System
7. CSA - Client Software Application
8. DGM - Dynamic Graphical Maps
9. DIN - German Institute of Standardization
10. DPS - Door Position Switch
11. FCC - Federal Communications Commission
12. GLM - Genetec Lifecycle Management
13. GUI - Graphical User Interface
14. ID - Identification
15. I/O - Input /Output
16. ISC: Intelligent System Controller
17. ODBC - Open Database Connectivity
18. O&M - Operations and Maintenance
19. PIN - Personal Identification Number
20. PTZ - Pan/Tilt/Zoom
21. RAID - Redundant Array of Independent Disks
22. REX - Request to Exit
23. RoHS - Restriction of Hazardous Substances Directive
24. SCS - Security Control System
25. SDRAM - Synchronized Dynamic Random Access Memory
26. SSM - Server Software Module
27. SSI - Security Systems Installer
28. STP - Shielded Twisted Pair
29. UI - User Interface
30. UL - Underwriters Laboratories, Inc.
31. UPS - Uninterrupted Power Supply
32. USB - Universal Serial Bus
33. USP - Unified Security Platform
34. USW - Unified Web Client
35. UTP - Unshielded Twisted Pair
36. VMS - Video Management System
37. VOC - Volatile Organic Compounds

1.7 GLOSSARY OF TERMS

A. The following terms are defined for the purposes of this specification:

1. Access Group: A logical group of card readers (terminals) which may be connected to one or more sub-controllers and which represent a collection of readers for which a particular cardholder may have access privileges.
2. Access Mode: The mode of operation in which the security control system shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. Also referred to as alarm shunting.
3. Acknowledge: The action taken by a security control system operator to indicate that he/she is aware of a specific alarm or tamper state.
4. Action Messages: A set of instructions automatically provided to the operator when an alarm condition is generated.
5. Advisory: A message provided by the security control system to the operator to inform him/her of a condition as reported by the security control system.
6. Alarm Condition: A change of state, as sensed by the security control system, indicating that the security control system has detected a condition which its sensors were designed to detect.
7. API Integration: a method to transfer information between two systems by means of APIs, though an Ethernet communication network.
8. Cardholder: A person who has been issued a valid access card.
9. Card Reader: A device usually located at access points, designed to decode the information contained on or within a card key credential for the purposes of making an access decision or for identity verification.
10. Clear: The action taken by a security control system operator to respond to an alarm condition or advisory so that other alarms may be serviced or so that other actions may be taken.

11. Download: To send computer data from the File Server to a controller for the purposes of making access decision without the intervention of the File Server.
12. Facility Code: A coded number, in addition to the individual card number, stored within each card key that uniquely identifies the facility at which the card is valid. This feature prevents cards from one facility from being used at another facility that has a similar access control system.
13. File Server: Primary host computer in the networked security system which maintains the access control system database.
14. Line Supervision: The monitoring of an electrical circuit via electrical and software systems to verify the electrical integrity of the supervised circuit.
15. Off-line: A condition in which a controller(s) is not in communication with the File Server. In the off-line mode, the controller continues to make access decisions and process alarms according to the information stored at its local database.
16. Password: A combination of numbers or letters unique to security control system operator which defines commands and data fields he/she may view, edit, or command.
17. Relay integration: A method to transfer signals between two systems by means of using potential free contact closures to input points.
18. Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state after having transferred to the alarm or trouble state.
19. Secure Mode: The normal state of an alarm input point from which it will be monitored for change of state to either an alarm or trouble condition.
20. Secured Area: A physical location within the facility to which access is controlled by one or more card readers.
21. Secured side: Side of a security door where a higher security level needs to be granted for a user to be authorized to be in that side of the door.
22. Serial line integration: A method to transfer information between two systems by means of an RS-232/RS-422 or RS-485 line, using ASCII strings.
23. Tamper: A condition within the circuitry of a monitored point which indicates the electrical integrity of that sensing circuit has been compromised.
24. Tamper proof screws: A screw with a security hexalobular internal driving feature as described in ISO 10664. As an example, a security TROX head, as developed by Camcar LLC.
25. Time Interval: A time stamp of one start time and one stop time within a time period.
26. Time Period: A user programmable period of time made up of days of the week and hours in the day.
27. Trouble: A condition within the circuitry of a monitored point which indicates that an equipment malfunction, single break, single fault or a wire-to-wire short exists.
28. Unsecured side: Side of a security door where a lower security level needs to be granted for a user to be authorized to be in that side of the door.
29. User Definable: An attribute of a security control system function that may be easily tailored by the System Administrator.
30. Workstation: A personal computer connected to the main security control system File Server via a local area network connection for the purpose of programming the system and responding to alarms.

1.8 SYSTEM DESCRIPTION

- A. The security systems primary purposes shall be to provide access control and alarm monitoring capabilities for this project. The system shall provide functionality such as the ability to regulate and control access through specific areas of the facility. The ACS shall be an enterprise class IP access control software solution. It shall be fully embedded within a Unified Security Platform (USP). The USP shall allow the seamless unification of the ACS with an IP video management system (VMS). The ACS shall be based on an open architecture able to support multiple access control hardware manufacturers. The ACS shall be able to integrate with multiple non-proprietary interface modules and controllers, access readers, and other third party applications.
- B. A real-time graphical map representing the layout of this building shall indicate if an electronically controlled door is in a secure or unsecured mode. Control modules will be required to lock, or unlock, any electronically controlled door at this facility.

1.9 SEAMLESS UNIFICATION WITH VMS

- A. Through the USP, the ACS shall support integration with an IP Video Surveillance System. Integration with an IP video surveillance system shall permit the user to view live and recorded video.
- B. Users shall be able to associate one or more video cameras to the following entity types: doors, elevator and hardware zones (input points), and more.

- C. The Monitoring UI shall present a true Unified Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.
- D. It shall be possible to view video associated with access control events when viewing a report.

PART 2 - SYSTEM CHARACTERISTICS

2.1 SECURITY SYSTEMS

- A. The SSI shall provide all hardware and software required for the complete expansion of the system and shall provide all system configuration to interface this new equipment to the existing headend systems.
- B. This system will be monitored remotely from the clients existing security command center, only panels and access control system controller are required at this site.
- C. Acceptable products for the security system are:
 - 1. Apollo Intelligent Security Solutions (Access Control system)
 - 2. Honeywell Vista 128 (Intrusion Alarm system)
- D. The Apollo access control system and Honeywell Vista intrusion alarm system are the established standard for this client, substitutions will not be considered.

2.2 COMPUTER SYSTEM HARDWARE

- A. The owner shall provide this hardware if determined to be needed at this site. Currently there are no plans for on-site system monitoring.

2.3 ACS CONTROLLER UNIT MANAGEMENT

- A. The Access Control System (ACS) shall support the discovery, configuration, and management of IP enabled controllers and I/O modules (hardware units). A user shall be permitted to add, delete, or modify a controller if they have the appropriate privileges.
- B. The ACS shall support automatic unit discovery. The user shall establish the settings for discovery ports and for the types of unit discovery and the ACS shall automatically detect all connected devices.

2.4 ACS CREDENTIAL MANAGEMENT

- A. The ACS shall support the configuration and management of credentials, for example access cards and keypad PIN numbers. A user shall be able to add, delete, or modify a credential if the user has the appropriate privileges. The ACS shall also support duress PIN.
- B. Users shall be able to add Custom Fields (user-defined fields) to credentials. Creating a new credential shall be accomplished either manually or automatically.
- C. Automatic creation shall allow the user to create a credential entity by presenting a credential to a selected reader. The ACS shall read the card data and associate it to the credential entity. It shall be possible to automatically enroll any card format.
- D. The ACS shall support multiple credentials per cardholder without necessitating duplicate cardholder information. The ACS shall automatically detect and prevent attempts to register an already-registered credential.

2.5 ACCESS LEVELS

- A. Coordinate with the client on the setup & programming of all new access levels for this facility.

2.6 ADA SUPPORT – ALTERNATE SHUNT

- A. The system shall provide the ability to control a door for cardholders requiring assistance or an alternate shunt time. The system shall provide the ability to tag a card indicating the person requires additional shunt time. When the person presents their card at a door, and the person is authorized for that door, the system shall unlock the door as normal and shall activate a second output control relay, which may be used to control a door-opening device. The shunt time for the door shall be extended beyond the normal shunt time allowing the person requiring the alternate shunt to pass through the door without generating an alarm.

2.7 DOOR CONTROL CONFIGURATIONS

- A. The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if they have the appropriate privileges. The ACS shall permit multiple access rules to be associated to a door. It shall be possible to unlock all doors from an area at once.
- B. The ACS shall support the following forms of authentication: Card Only, Card or Keypad (PIN), or Card and Keypad (PIN). It shall be possible to define a schedule for when Card Only or Card and Keypad authentication modes shall be required.
- C. It shall be possible to set an extended grant time on a per-door basis (in addition to the standard grant time). Cardholder properties shall include the option of using the extended grant time. When flagged cardholders are granted access, the door shall be unlocked for the duration of the extended grant time instead of the standard grant time.
- D. The ACS shall allow the configuration of the relocking mode on doors such as on door open, after a definite time, or on door close.
- E. The ACS shall support the ability to enable unlocking schedule on a door once an employee has entered the facility.
- F. Unlocking schedules and exceptions to unlocking schedules shall be associated with a door. An unlocking schedule shall determine when a door should be automatically unlocked. The ACS shall also support the use of a specific offline unlocking schedule. Exceptions to unlocking schedules shall be used to define time periods during which unlocking schedules shall not be applied, such as during statutory holidays.
- G. The ACS shall support one or more cameras per door. Video shall then be associated to door access events, such as access grant or access denied.

2.8 ALARM FORWARDING

- A. The security control system shall allow for forwarding of an alarm condition from one destination to an auxiliary or backup destination in the event an alarm is not acknowledged within a predefined period of time.

2.9 EVENT AND ALARM MESSAGE ROUTING

- A. Coordinate with the client on the setup and configuration of event, alarm messages and automatic routing of email notifications.

2.10 VIDEO AND CAMERA CONTROL

- A. Control station or designated workstation displays live video from a CCTV source.
 - 1. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.
 - 2. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.
 - 3. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.
- B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.
- C. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.

2.11 SECURITY MANAGEMENT FIELD HARDWARE

- A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294 requirements. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. All security panels shall be the most current generation of Mercury hardware, (red logic boards), incorporation cyber security protocols.
- B. The system shall utilize a distributed processing architecture whereby all access decisions are made locally at the controller. The host computer shall download controller specific data to the Intelligent System Controllers on the network. This data shall be stored within each controller and contain all pertinent

information relating to the controller's functionality. Should communication with the file server be lost, all event activity, with its time date stamp, shall be stored in the controller buffer, until communication is restored. Upon restoration of communications all transaction data shall be automatically uploaded to the host computer including the actual time of occurrence. This functionality shall enable any off-line controller to maintain full access control processing capability.

- C. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components: All components shall be Mercury hardware and shall be the most current generation of this hardware,
 - 1. Intelligent System Controller: AAN-32
 - 2. 4 Reader Network Integrated Controller with 16 Inputs, 8 Outputs: ASP-4
 - 3. 2 Reader Interface Module: AIM-2SL
 - 4. Input/ Output Module with 16 Inputs, 8 Outputs: ASP-IO68
 - 5. UL listed power supplies and enclosures

2.12 CONTACTLESS CARD READER

- A. The standard card reader for use throughout this facility shall be a switchplate style reader in low profile weatherized polycarbonate housing suitable for mounting in either an indoor or outdoor environment. The reader shall be constructed of a polycarbonate material sealed to a NEMA rating of 4X IP65. The reader shall contain an integral magnet for use with an external magnetic reed switch to provide tamper protection when connected to an external alarm. The reader shall be UL/C 294 listed and shall conform to FCC and ISO standards. The reader shall operate at a frequency of 13.56MHz 125KHz. All RF data transmitted between this device and the card shall be encrypted for additional protection using a secure algorithm. The reader shall provide an audiovisual indication to signify access granted or access denied. This operation shall be displayed by a high intensity LED light bar which shall change from red, amber, or green based on the status of the operation. The housing shall mount on an industry standard single gang electrical junction box.
- B. The card reader with keypad shall have a standard contactless smart card and shall have a twelve (12) key keypad. Readers with keypad shall be used where indicated in design drawings.
- C. Communications between the readers and the ISC shall be through a Wiegand or OSDP interface.
- D. The card reader for this project shall be:
 - 1. The Indala compatible proximity card reader shall be the HID SIGNO series model 40 switch-plate style reader for standard applications and model 20 for mullion mount applications.
 - 2. The mullion style readers shall only be used where wall mounting is not possible (for example glass/aluminum store-front systems).
 - 3. When mounted on a metal surface the reader installation shall include a polycarbonate backplate to offset the reader from the metal surface.

2.13 CONTACTLESS SMART ACCESS CARDS

- A. The access cards for the access control system shall be owner provided.

2.14 REMOTE DOOR RELEASE BUTTONS (UNDER DESK)

- A. Where indicated on the drawings, a door release button shall be provided to function as a secondary method of door release on electronically locked doors. The door release button shall have the following specifications: The enclosure shall be made of a brushed aluminum enclosure with 1, 2, or 3 push buttons to control multiple doors. It shall have an led indicator light for each button and buttons shall be momentary in operation. i.e. will remotely unlock a door as long as the button is held in. Upon release the door shall relock. These unlock operations must occur at the access control panel, not between button and door.
 - 1. The one-button remote door release controller with (1) LED indicator light shall be the Dortronics 5236-xP15-xL
 - 2. The two-button remote door release controller with (2) LED indicator lights shall be the Dortronics 5236-x2P15-xL2
 - 3. The three-button remote door release controller with (3) LED indicator lights shall be the Dortronics 5236-x3P15-xL3

2.15 MAGNETIC DOOR POSITION SWITCH – DPS

- A. The contact and the magnet shall be hermetically sealed in a one piece, molded, flame retardant ABS plastic housing for maximum strength and durability. The contact and magnet shall snap-lock into a

predrilled 3/4" or 1" diameter hole. Color of the housing shall be off white, gray, or mahogany, and shall be provided in the appropriate color to match the door and doorframe.

1. The standard DPS for steel doors shall be Honeywell 944TSP series or equal.
2. The standard DPS for wood doors shall be Honeywell 944 series or equal.
3. The high security surface mounted door position switch for roof hatch locations shall be Honeywell 960 series or equal.

- B. On banks of doors where multiple doors are being monitored, door contacts shall be wired in series. All double doors shall receive (1) magnetic door position switch on each door leaf and shall report as one alarm point.

2.16 TAMPER SWITCH

- A. All security enclosures, including power supplies and terminal cabinets shall include a tamper switch for direct supervision of the cabinet door. Any opening of these doors shall initiate an alarm condition to the security monitoring system. All tamper contacts shall be a reed actuated self-adjusting plunger style switch. If a tamper contact is provided by the manufacturer with the enclosure this device may be used. Tamper switches shall be wired as to report separate alarms to the system for each panel.

1. The tamper switch for equipment enclosures shall be the Honeywell 955WH or built-in tamper contact inside system enclosure.

2.17 DURESS PANIC BUTTON – UNDER DESK & WALL MOUNTED

- A. The under desk mounted duress button shall consist of a housing that contains the electrical circuitry and magnetic reed contact, and the actuating button in the unit. There shall be a guard around the pushbutton to prevent accidental activation. Obtain client approval on placement at the desk prior to installing these devices.

1. The under desk mounted duress button shall be a United Security Product (USP) HUB2SA duress button.

- B. The wall mounted duress button shall consist of a red mushroom style button with key reset and a stainless steel face plate. The duress button shall mount directly to an industry standard single gang junction box with tamper resistant screws.

1. The wall mounted duress button shall be a Dortronics 5211-MP23/KR or equal.

2.18 360 DEGREE MOTION DETECTOR

- A. The 360 motion detector shall be a dual technology device requiring the movement and an infrared signature to alarm.

1. The ceiling mounted 360-degree motion detector shall be a Honeywell 997 sensor.

2.19 DIRECTIONAL MOTION DETECTOR

- A. The directional motion detector shall be a dual technology device requiring the movement and an infrared signature to alarm. It shall include a wall mounting bracket allowing adjustment to the area of coverage.

1. The wall mounted motion detector shall be a Honeywell sensor.

2.20 ACOUSTICAL GLASS BREAK DETECTOR

- A. The glass break detector shall be a recessed ceiling mounted device. It shall provide acoustical monitoring for breaking glass.

1. The ceiling mounted glass break detector shall be a Honeywell FG1625 RFM sensor.

2.21 SURGE PROTECTION

- A. All security components mounted outside the building and wired through low voltage copper conductor back to the building shall be provided with surge and lightning protection. Provide UL listed multi-stage protection on all low voltage and signal transmission lines. All 120 VAC surge suppression devices shall be Emmerson/ EDCO HSP121BT-1RU or an approved equal. For low voltage connections provide FAS-1 surge suppressors manufactured by Emmerson/ EDCO or an approved equal. For RS-485 or RS-422 connections provide PC642C-008LC with base PCB1B manufactured by Emmerson/ EDCO or an approved equal.

- B. For exposed Ethernet connections with PoE, use Emmerson/ EDCO CAT6-E PoE or approved equal.

2.22 POWER SUPPLIES ELECTRONIC DOOR HARDWARE - COORDINATE WITH DIVISION - 8

- A. The low voltage power supply shall convert a 115 VAC 60 Hz input to a continuously supplied current of 12 or 24 VDC. The power supply shall be UL listed, NFPA compliant, and class 2 rated. The power supply shall be housed in NEMA 1 hinged cover enclosures where mounted indoors and in fully weatherproof NEMA 4 enclosures when located in an outdoor environmental conditions. All enclosures shall be key lockable, keyed alike, and shall include a tamper switch for monitoring of the door. All cabinet opening shall initiate an alarm condition to the security monitoring system.
 - 1. The low voltage power supplies for low voltage door hardware shall be Altronix model AL400ULACM or an approved equal.
- B. Reference Division 8 door hardware specifications for requirements that may be associated with door locking hardware power supplies. Security installer shall be responsible for ensuring power supplies are sized to accommodate voltage drop based on distance and size of cable run.
- C. Power supplies for "Chexit" Delayed Egress Latch locks and "Non" QEL Electric Latch locks shall be provided by the door hardware contractor. Reference the Division 8 door hardware specifications for additional information on this issue to ensure this is fully coordinated and included in this scope as referenced.
- D. Reference Division 8 door hardware specifications for electronic locks that need to be released on fire alarm. A fire alarm relay shall interrupt power to the lock unlocking the door totally independent of the access control system. The fire alarm system must be the primary system responsible for this operation as required by the life safety code. The security installer is responsible for coordinating this fire alarm interface and connection with the fire alarm contractor under this scope of work. Reference the fire alarm and electrical design documents for additional information.
- E. The power supply for door locks and powered sensors shall include a battery charger and a battery input to provide power to the locks after a main power system failure. The switchover to stand-by battery shall be automatic when main AC power fails.
- F. Power supplies for regular locking hardware shall be installed next to access control panels.
- G. Maintenance free batteries shall be provided with all power supplies. Batteries shall be sized to allow at least 4 hours of power backup. All power supplies shall be monitored for low battery through the access control system.
- H. The power supply for door locks and powered sensors shall have the following features:
 - 1. Number of outputs: 8 programmable as fail-safe or fail secure individually
 - 2. Fire alarm disconnect: Yes, latching or unlatching and individually selectable for any of the inputs.
 - 3. Output protection: PTC
 - 4. Monitoring: AC fail and low battery with dry contact closure.
 - 5. The low voltage power supply for door locking hardware shall be Altronix Maximal series or equal.

2.23 POWER SUPPLY FOR ACCESS CONTROL SYSTEM

- A. All ISCs and other boards part of the access control system shall be installed inside a metal enclosure with a power supply as recommended and designed by the manufacturer of the equipment.
- B. The low voltage power supply shall convert a 115 VAC or 24 VAC 60 Hz input to a continuously supplied current of 12 or 24 VDC. The power supply shall be UL listed, fused protected and class 2 rated.
- C. The power supply shall include a battery charger to provide backup power when main power goes down. If ISC has a battery charger and input built in, then the power supply does not need this feature.
- D. Plug in transformers feeding a low voltage power supply feeding an access control panel are not allowed unless they are mounted inside another lockable enclosure. External multi-output individually fused protected outputs power supplies feeding all access control board are acceptable as long as they are located next to the access control panels.
- E. Maintenance free batteries shall be provided with all power supplies or ISC and shall be mounted inside the same enclosure. Batteries shall be sized to allow at least 4 hours of power backup. All power supplies shall be monitored for low battery through the access control system.
- F. All enclosures for ISCs, other electronic boards, power supplies or battery cabinets shall be UL listed NEMA 1 hinged cover enclosures where mounted indoors and in fully weatherproof NEMA 4X 316 stainless steel enclosures when located outdoors or in an exposed or covered area. All enclosure doors shall be key lockable, keyed alike, and shall include a tamper switch for monitoring by the security system. Any cabinet opening shall initiate an alarm condition to the security monitoring system.

2.24 LOCAL ALARM ANNUNCIATOR

- A. The local alarm shall be a buzzer with strobe light that mounts in a double gang electrical box. The buzzer shall have an output capacity of 70 db @ 10 ft. from the source and. The strobe light shall radiate light at 75 cd. The local alarm shall be white and shall have no lettering.
1. The local annunciator shall be Gentex GEC3-12PWW or equal.

2.25 KEY SWITCH

- A. The key switch shall be a capable of fitting in a dual gang box with a single device adapter. The specifications of the key switch are:
1. Plate construction: 1/4" extruded aluminum plate
 2. Switch mode operation: maintained action.
 3. Switch configuration: one SPDT and one DPDT
 4. Cylinder: Match owner's keying standard.
 5. Screws: tamper resistant.
 6. LED: bi-color (red-green) mounted in plate.
 7. Design selection: Dortronics model 5140 series key switch with brass key cylinder or equal.

2.26 EXTERIOR EQUIPMENT ENCLOSURE

- A. NEMA 4X rated stainless steel enclosures shall be provided to house electronic security equipment to all vehicle gates. The enclosure shall be constructed of 14 gauge stainless and shall have dimensions as required to hold electronics.
- B. All enclosures shall be provided with a pad lock and a tamper switch for direct supervision. Any door opening shall initiate an alarm condition to the security monitoring system. All cores shall be keyed alike. A grounding package shall be provided for connection to a ground rod. A #8 solid copper ground wire shall be provided and installed from the ground lug to a grounding rod installed next to the enclosure.
- C. All exterior enclosures shall include a compact air condition unit. The air condition unit shall be as indicated in the design drawings. All air condition units shall be monitored for proper operation through relay contacts through the access control system.
1. The exterior enclosure, appropriately sized for the specific need, shall be the Hoffman/ nVent Watershed type Nema-4X 316 stainless steel enclosure or equal.

2.27 INTRUSION ALARM SYSTEM

- A. Basis-of-design shall be the Honeywell VISTA 128BPT System, a burglary/access control/CCTV switching system that includes the following capabilities:
1. Listed for UL Commercial Burglary.
 2. Compatible Detection Devices: Addressable.
 3. Addressable Inputs: 120.
 4. Onboard Communication: Digital Dialer.
 5. Onboard Inputs: 9.
 6. Communication Choices: Digital Dialer, TCP/IP, GSM.
 7. Event Log: 512.
 8. Supports up to 128 zones.
 9. Supports up to 8 separate partitions.
 10. Supports up to 150 users.
 11. Supports commercial wireless devices.
 12. Wireless Inputs: 127.
 13. Provides supervision of peripheral devices.
 14. Supports up to 96 relay outputs.
 15. Supports long-range radio (LRR) communication.
 16. Provides scheduling capability to allow for automated operations.
 17. Supports alarm reporting via Internet.
- B. Environmental Conditions: System shall be designed to function in the following environmental conditions:
1. Storage Temperature: Designed for a storage temperature of -10 degree C to 70 degree C.
 2. Operating Temperature: System shall be designed for an operating temperature of 0 degree C to 50 degree C (32 degree F to 120 degree F).
 3. Humidity: System shall be designed for normal operation in an 85% relative humidity environment.
 4. Electromagnetic Interference: System shall meet or exceed the requirements of FCC Part 15, Class B devices, FCC Part 68, IEC EMC directive.

- C. Power Requirements: Components shall have the following electrical specifications. The system shall operate using standard 120 VAC, 50 Hz/60 Hz power.
1. Control Primary Power: Transformer power shall be 16.5 VAC, 40 VA.
 2. Backup Battery: Rechargeable 12 VDC, gel type, lead acid backup battery shall be provided. The battery shall be rated between 12 and 34-ampere hours (AH).
 3. Alarm Power: 12 VDC, 1.7 amps for each bell output
 4. Auxiliary Standby Power: 12 VDC, 0.75 amp maximum.
 5. Total Power: Combined auxiliary standby and alarm currents shall be 2.3 amps.
 6. Fusing: The battery input, auxiliary, and bell outputs shall be protected using PTC circuit breakers. All outputs shall be power limited.
- D. Control Panel Enclosure: A metal cabinet, suitable for wall mounting. Dimensions shall not exceed 14.5 inches (36.8 cm) in height, 12.5 inches (31.8 cm) in width or 3 inches (7.6 cm) in depth.
- E. Control Panel: The control panel shall be an 8-partition, UL commercial and burglary control panel that supports zones using basic hardwired, polling loop, wireless zones, RF receivers, and relay modules. The control shall provide the ability to schedule time-driven events and allow certain operations to be automated by pressing a single button. The system shall be capable of interfacing with an ECP long range radio (LRR) unit that can send Contact ID messages. The control shall provide integrated access control and CCTV-switching capability with the use of a single downloader and database.
1. Basic Hardwired Zones: Control shall provide 8 style-B hardwire zones with the following characteristics:
 - a. EOLR supervision (if required for zones 2-8) shall support N.O. or N.C. sensors (EOLR supervision required for UL installations).
 - b. Zones/Points shall be individually assignable to any partition.
 2. Partitions: Control shall provide the ability to operate e8 separate areas, each functioning as if it had its own control. Partitioning features shall include:
 - a. A Common Lobby partition (1-8), which can be programmed to perform the following functions:
 3. Partitions: Control shall provide the ability to operate 8 separate areas, each functioning as if it had its own control. Partitioning features shall include:
 - a. A Common Lobby partition (1-8), which can be programmed to perform the following functions:
 - 1) Arm automatically when the last partition that shares the common lobby is armed.
 - 2) Disarm when the first partition that shares the common lobby is disarmed.
 - b. A Master partition (9), used strictly to assign keypads for the purpose of viewing the status of all 8 partitions at the same time (master keypads).
 - c. Assignable by zone.
 - d. Assignable by keypad/annunciator.
 - e. Assignable by relay to one or all 8 partitions.
 - f. Ability to display burglary and panic and/or trouble conditions at all other partitions' keypads (as a selectable choice).
 - g. Certain system features selectable by partition, such as entry/exit delay and subscriber account number.
 4. User Codes: Control shall accommodate user codes, all of which can operate any or all partitions. Certain characteristics must be assigned to each user code, as follows:
 - a. Authority level (Master, Manager, or several other Operator levels). Each User Code (other than the installer code) shall be capable of being assigned the same or a different level of authority for each partition that it will operate.
 - b. Opening/Closing central station reporting.
 - c. Specific partitions that the code can operate.
 - d. Global arming capability (ability to arm all partitions the code has access to in one command).
 - e. Use of an RF (button) to arm and disarm the system (RF key must first be enrolled into the system).
 5. Peripheral Devices: Control shall support up to 30 addressable ECP devices, which can be any combination of keypads, RF receivers, relay modules, and interactive phone module. Peripheral devices have the following characteristics:
 - a. Each device set to an individual address according to the device's instructions.
 - b. Each device enabled in system programming.
 - c. Each device's address shall be supervisable (via programming).

6. Keypad/Annunciator: Control shall accommodate up to 16 keypads or six (6) touch-screen (i.e.; advanced user interface) keypads. The keypads shall be capable of the following
 - a. Performing all system arming functions.
 - b. Being assigned to any partition.
 - c. Providing four programmable single-button function keys, which can be used for:
 - 1) Panic Functions: activated by wired and wireless keypads; reported separately by partition.
 - 2) Keypad Macros: 32 keypad macro commands per system (each macro is a series of keypad commands). Assignable to the A, B, C, and D keys by partition.
7. Output Relays: A total of 96 relay outputs shall be accommodated using relay modules. Each relay module shall provide four (4) Form C (normally open and normally closed) relays for general-purpose use. The relays shall be capable of being:
 - d. Programmed to activate in response to system events.
 - e. Programmed to activate using time intervals.
 - f. Activated manually.
 - g. Assigned an alpha descriptor.
 - h. A combination of 4204 (ECP) and 4101SN (polling loop) relays.
8. Voltage Triggers: System shall provide voltage triggers, which change state for different conditions. Used with devices such as a remote keypad sounder or keyswitch ARMED and READY LEDs.
9. Event Log: System shall maintain a log of different event types (enabled in programming). The event log shall provide the following characteristics:
 - i. Stories events.
 - j. Viewable at the keypad or through the use of Compass software.
 - k. Printable on a serial printer, including zone alpha descriptors.
10. Scheduling: Provides the following scheduling capabilities:
 - l. Open/close schedules (for control of arming/disarming and reporting).
 - m. Holiday schedules (allows different time windows for open/close schedules).
 - n. Timed events (for activation of relays, auto-bypassing and un-bypassing, auto-arming and disarming, etc.).
 - o. Access schedules (for limiting system access to users by time).
 - p. End User Output Programming Mode (provides 20 timers for relay control).
 - q. The system shall automatically adjust for daylight savings time.

B. User Interface Keypad

11. Keypad, Alpha Display: The system keypad shall include a two-line, alphanumeric LCD display. Use the Honeywell Premier 6160 keypad or equivalent.

2.28 WIRE & CABLE

- A. Access Control Composite Cable – (Standard - unshielded), CMP plenum rated, yellow jacket: Belden 658AMJ or equal.
 1. Lock Power: 4C - 18 AWG, Unshielded (Grey)
 2. Card Reader: 3PR - 22 AWG, OA Shielded (Orange)
 3. Door Contact: 2C - 22 AWG, Unshielded (White)
 4. Request to Exit: 4C - 22 AWG, Unshielded (Blue)
- B. Access Control Composite Cable – (Standard - shielded), CMP plenum rated, yellow jacket: Belden 658AFJ or equal.
 1. Lock Power: 4C - 18 AWG, Shielded (Grey)
 2. Card Reader: 3PR - 22 AWG, OA Shielded (Orange)
 3. Door Contact: 2C - 22 AWG, Shielded (White)
 4. Request to Exit: 4C - 22 AWG, Shielded (Blue)
- C. Access Control Composite Cable – (Extended Distance unshielded), CMP plenum rated, yellow jacket: Belden 638AMJ or equal.
 1. Lock Power: 4C - 16 AWG, Unshielded (Grey)
 2. Card Reader: 3PR - 18 AWG, OA Shielded (Orange)
 3. Door Contact: 2C - 18 AWG, Unshielded (White)
 4. Request to Exit: 4C - 18 AWG, Unshielded (Blue)

- D. Access Control Composite Cable – (Extended Distance shielded), CMP plenum rated, yellow jacket: Belden 638AFJ or equal.
1. Lock Power: 4C - 16 AWG, Shielded (Grey)
 2. Card Reader: 3PR - 18 AWG, OA Shielded (Orange)
 3. Door Contact: 2C - 18 AWG, Shielded (White)
 4. Request to Exit: 4C - 18 AWG, Shielded (Blue)
- E. Cables for un-powered security sensors shall have the following specification:
1. Minimum cable gauge: AWG 20
 2. Number of conductors: 2, stranded conductors
 3. Conductor type: Bare copper
 4. Cable insulation: Color coded PVC
 5. Conductor insulation colors: Black and red.
 6. Voltage rating: 300V
 7. Cable shield: No cable shields
- F. Cables for powered security sensors shall have the following specifications:
1. Minimum cable gauge: AWG 20
 2. Number of conductors: 4, stranded conductors
 3. Conductor type: Bare copper
 4. Cable insulation: Color coded PVC
 5. Conductor insulation colors: Black, red, white and green.
 6. Voltage rating: 300V
 7. Cable shield: No cable shields
- G. Cables for access control readers shall have the following specifications:
1. Minimum cable gauge: AWG 22
 2. Number of conductors: 6, stranded conductors
 3. Conductor type: Tinned copper
 4. Cable insulation: Color coded PVC
 5. Conductor insulation colors: Black, red, white, green, orange (or brown) and blue.
 6. Voltage rating: 300V
 7. Cable shield: Aluminum/polyester foil (overall) with a AWG 24 tinned copper drain wire
- H. Cables for RS-232, RS-422 or RS-485 control lines shall have the following specifications:
1. Minimum cable gauge: AWG 24
 2. Number of conductors: 2-paired, stranded conductors
 3. Conductor type: Tinned copper
 4. Cable insulation: Polyethylene
 5. Conductor insulation colors: White-blue, blue-white white-orange and orange-white
 6. Voltage rating: 300V
 7. Cable shield: Aluminum/polyester foil (overall), a tinned copper braid (90% coverage) and a AWG 24 tinned copper drain wire
 8. Nominal characteristic impedance: 120 Ohms
 9. Nominal capacitance: 12.8 pF/ft.
 10. Nominal delay: 1.6 ns/ft.
 11. Nominal attenuation: 0.6 dB/100 ft @ 1 MHz.
- I. Cables for door locks and low voltage power supplies shall have the following specifications:
1. Minimum cable gauge: AWG 18
 2. Number of conductors: 2, stranded conductors
 3. Conductor type: Bare copper
 4. Cable insulation: PVC
 5. Conductor insulation colors: Black and red.
 6. Voltage rating: 300V
 7. Cable shield: No cable shields
- J. Cables for loop detectors shall have the following specifications:
1. Minimum cable gauge: AWG 16
 2. Number of conductors: 1, stranded conductors
 3. Conductor type: Bare copper
 4. Cable insulation: Cross-linked polyethylene (XLPE)
 5. Conductor insulation colors: Black

6. Voltage rating: 600V
 7. Cable shield: No cable shields
 - K. Intrusion Detection System components shall be connected using the following Honeywell Genesis Series Cables:
 1. Keypads use four conductor, 18AWG with 22AWG, non-shielded cable:
 - a. Element 1: 18AWG:
 - 1) General Purpose applications: Part #: 1119.
 - 2) Riser applications: Part #: 2115.
 - 3) Plenum applications: Part #: 3115.
 - b. Element 2: 22AWG:
 - 1) General Purpose applications: Part #: 1104.
 - 2) Riser applications: Part #: 2104.
 - 3) Plenum applications: Part #: 3104.
 2. Unpowered detection devices connect to zone inputs using two conductor,
 - a. 22AWG, non-shielded cable.
 - 1) General Purpose applications: Part #: 1102.
 - 2) Riser applications: Part #: 2102.
 - 3) Plenum applications: Part #: 3102.
 3. Powered detection devices connect to zone inputs using four conductor,
 - a. 18AWG, non-shielded cable.
 - 1) General Purpose applications: Part #: 1119.
 - 2) Riser applications: Part #: 2115.
 - 3) Plenum applications: Part #: 3115.
 - 4) Direct burial applications: Part #: 4157.
 4. The Bell output shall use two conductor,
 - a. 16AWG, non-shielded cable.
 - 1) General Purpose applications: Part #: 1125.
 - 2) Riser applications: Part #: 2121.
 - 3) Plenum applications: Part #: 3121.
 5. Power connections for control panels shall be made using two conductor,
 - a. 16AWG, non-shielded cable.
 - 1) General Purpose applications: Part #: 1125.
 - 2) Riser applications: Part #: 2121.
 - 3) Plenum applications: Part #: 3121.
 6. Ground connections to control panels shall be made using
 - a. 14AWG solid insulated copper ground wire.
 - 1) General Purpose applications: Part #: 1131.
 - L. All UTP Category horizontal cables and fiber optic cables for the security system shall be in compliance of all requirements in specification section 271500 and shall be under the same warranty as all UTP category cables and fiber optic cables described in specification section 271500.
 - M. Cable gauge: All cable gauges shall be estimated as to allow a maximum of 5% voltage drop from the source to the load. Sizes given previously are only minimum gauges accepted. The SSI shall always estimate proper values.
 - N. Cable jackets: All cable jackets shall be suitable for the environment on which the cables will be installed. Use plenum rated cables when cables are installed in plenum spaces. Use riser rated cables when cables are installed through floor sleeves. Use cable jackets with water-blocking material when installed in underground conduits. All spaces above ceilings in this project shall be treated as plenum spaces. All cables with a NEC type TC shall be run fully in conduit from the panel to the device and shall be separated from other communication or Class 2 rated cables.
 - O. Cable jackets for this project: Except when cables are run continuously in conduit all cable jackets for access control cables shall be plenum rated.
 - P. All cables shall be RoHS compliant and free of VOC. The SSI shall provide proof of compliance for all cables during the submittal process.
 - Q. Acceptable manufacturers: Belden, Alpha Wire Company, General Cable and West Penn Wire.
- 2.29 IDENTIFICATION AND LABELING TAGS
- A. The SSI shall follow labeling materials indicated in specification section 270500

PART 3 - EXECUTION

3.1 SECURITY DOORS FUNCTIONALITY

- A. The following paragraphs described the expected functionality of the typical security doors. The SSI shall use this description to draw the one line diagrams part of the shop drawings and described in part 1 of this specification. The SSI shall make sure the proposed wiring for each door type produces the desired functionality for each door type.
- B. All control logic for this functionality shall be accomplished through local input/output events. Global events to accomplish these requirements are not allowed. Failure of the access control server shall not limit the functionality of the doors. When the word reader is used in the following descriptions, it means it is a generic device, it could be any type of reader (biometric, iClass, prox) with or without keypad, see the design drawings for particular selection for every door.
- C. Devices indicated in the following paragraph as provided by Door Hardware Installer are only the devices that are associated with the security system. For further instructions of additional passive door hardware devices to be provided, see Division 8 specifications.

3.2 SECURITY SYSTEM INTEGRATION

- A. General: A. The access control system software shall integrate with the other security system components as indicated in this section. The SSI shall be responsible for programming all security systems in such a way that interaction between the different systems is achieved to provide a higher degree of security in the building. The minimum required integration features between the access control and the other security systems are described below:
- B. ACCESS CONTROL AND DIGITAL VIDEO RECORDING SYSTEM
 - 1. The Access control software proposed shall integrate with the new Digital Video Recording System (DVRs) proposed for this project (refer to specification section 282000 for details on the Digital Video Recording System). The integration shall make the following features possible from the Access Control GUI:
 - a. Event video tagging. Selectable security events in the access control system shall tag the recorded video, so when the operator reviews the event, video from that moment in time when the event took place shall be retrieved automatically and brought into a window of the access control GUI.
 - b. DVRs playback control: Through the access control GUI, the operator shall be capable of controlling the video playback. The operator shall be capable of retrieving any recorded video from any camera by using a time search or an event search. The operator shall be capable of controlling the speed of the playback by selecting frame by frame playback or playback at higher speeds.
 - c. Live video: The operator shall be capable of displaying live video in window in the access control GUI. The operator shall be capable of selecting the camera in the system that he/she wants to see. Up to 4 live video windows (live or recorded) shall be possible in every workstation running the access control GUI.
 - d. PTZ Control: The operator shall be capable of controlling all PTZ features of a camera by simply using buttons in the Access Control screen with the orientation of movement.
 - e. Alarm event: Any alarm event (like video analytic alarms, or video motion detection) in the DVRs shall be transferred to the access control system for processing as any other alarm in the access control system. Alarms shall be uniquely identified in the access control system.
 - f. Status events: Any status events (system errors, or administration events) in the DVRs shall be transferred to the access control system for processing as any other status event in the access control system. Events shall be uniquely identified in the access control system.
 - g. Export/load video file: the operator shall be able to export or load video files compatible with the recording format of the DVRs from the access control GUI.
 - h. Recorder authentication: Since login is required for most DVRs, the login action on the Access Control System shall also grant access to the DVRs. Separate or further login to the DVRs shall not be required.
 - i. Dry contact control: The operator shall be capable of triggering relay contacts part of the DVRs equipment from the access control GUI.
 - j. Video locking: The operator shall be capable of locking video on the DVRs to prevent it from being purged accidentally. Locked video can be set to automatically purge or archive based on user defined thresholds.
- C. CCTV SYSTEM

1. Activation of access control system alarms (like door held open, door forced open, stolen/lost card used, duress alarm, alarms coming from other systems, etc) shall call presets in the nearest CCTV cameras (one or more) to point towards the device that is in alarm. This action shall take place without any operator's intervention.
2. Activation of access control system alarms shall call any associated camera to the triggered alarm to the operator's workstation alarm monitor. This action shall take place without any operator's intervention. When the alarm is cleared by the operator the image of the alarm monitor shall be removed. Alarms from doors in detention areas shall be received in the monitors in Master Control Room, alarms from doors in other areas shall be received in Building control room.
3. Video loss alarm: loss of video signal on any of the surveillance cameras in the system shall trigger an alarm in the access control system.
4. Graphic substation calling: Intercom substations shall be represented with graphic icons in the graphic maps part of the Access control system GUI. Double clicking on those icons shall automatically create a call to that substation from the master station associated with the user workstation initiating the command.
5. Graphic camera calling: Surveillance cameras shall be represented with graphic icons in the graphic maps part of the Access control system GUI. Double clicking on those icons shall automatically open a video window with a live stream from that camera.

D. DOOR ENTRY SYSTEM

1. Remote door release: During a call from a substation by an access controlled door to a master station, the user in the master station side shall be capable of opening the door by pressing a key in the master station keypad. This action shall not create any alarm conditions in the access control system.

E. ALARM SYSTEM.

1. Alarm events: Activation of a device in the alarm system shall be treated as an access control alarm event, calling camera presets, calling any associated cameras to the operator's alarm monitors and creating automatic intercom calls (if available). This action shall take place without any operator's intervention.
2. Status events: Status alarm conditions (faults or errors) shall be reported to the access control system with unique identifiers.
3. Graphic status: All alarm devices shall be represented with graphic icons in the graphic maps part of the access control system GUI. Alarm devices shall represent their status with a different color, red for "on alarm" condition, and green for "no alarm" condition in the graphic maps.

- F. Different methods of integration are allowed between the access control system and the other systems. Integration methods are given different hierarchy as follows, relay integration is lowest hierarchy, serial line integration is considered medium hierarchy integration and API integration is considered high hierarchy integration. At a minimum integration between the different security system shall be provided with the integration method explained below. It is acceptable for the SSI to propose integration methods with higher hierarchy integration methods, but not with lower hierarchy methods. The requested integration methods with each system are as follows:

1. Access control system and DVRS API integration.
2. Access control system and CCTV system API integration.
3. Access control system and Intercom system API integration.
4. Access control and door entry system Relay integration
5. Access control and Alarm system API integration
6. Access control and Paging system Serial line integration or API.

3.3 INSTALLATION PRACTICES

- A. General: The SSI shall follow all installation practices indicated in specification section 270500.
- B. Access control panels and multi-output power supplies shall be installed as to have in any cluster of panels no less than 2 spare ports (reader ports for access control) available per cluster of panels.
- C. All power supplies shall be monitored for AC failure. When power supply provides a form c relay with low battery signaling, this contact shall also be monitored. All AC fail and battery low alarms shall be monitored through individual alarm inputs. Series connections of multiple alarm points shall not be allowed.
- D. All buzzers inside card readers shall be wired as to function to alert users of different door status like (door held open alarm and door forced open alarm).
- E. All local alarms shall be wired with separate wires for the buzzer and for the strobe, so independent use of the strobe and buzzer can be selected by the user.

3.4 WIRING METHODS

- A. All proposed wire and cable shall meet or exceed the recommendations established by the equipment manufacturers, and shall comply with all state and local codes.
- B. Visually inspect all wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps.
- C. Provide grommets and strain relief materials where necessary to avoid abrasion and excess tension on wire and cable.
- D. All termination of UTP Category type multi pair cables shall be done in Insulation Displacement Connectors (IDC), modular plugs or connectors. The use of wire nuts or manually twisting cables and protecting them with electrical tape are not acceptable means of termination.
- E. All cable with gauges larger or equal to AWG-18 and all types of stranded conductors shall be terminated on termination blocks part of an active equipment or in termination blocks supplied by the SSI. The use of wire nuts or manually twisting cables and protecting them with electrical tape are not acceptable means of termination.
- F. All termination blocks shall always be mount inside a security enclosure, with a hinged cover and lock. Up to 2 conductors can be terminated in the same point in a termination block as long as the combined diameter of the conductors does not exceed the maximum cable diameter allowed by the termination block. No more than 2 conductors shall be terminated in the same point at a termination block regardless of the cable gauges.
- G. Termination blocks shall be used for wire terminations next to access control panels or for termination above the security doors. Termination blocks are not required for connection to security devices at the door side.
- H. When equipment supplied has wire leads instead of termination end points for connections, the only acceptable methods of connection to field wiring are insulated butt splices, quick release connectors (both ends provided) or quick lock self-stripping pig tail connectors. All connectors or splices shall be selected according to the gauge of the cable to be terminated.
- I. All penetrations through fire rated barriers shall be provided, by the SSI, with appropriate fire stopping materials in accordance with NFPA requirements and local fire authority having jurisdiction.
- J. All cable runs shall be continuous from the device to the equipment. Cable splices shall not be allowed inside conduits, or cable trays.
- K. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with different potential. Exposed wire bundles or individual cables shall be neatly secured with self-clinching nylon "TY-Raps" (Thomas & Betts or equal).
- L. All cables run part of the security system in areas where ceiling is not accessible or in building exterior shall be in conduit at all times.
- M. All cables for security equipment shall be installed in conduit to the nearest accessible ceiling space, J-hook to the cable tray and from the cable tray and from the tray to the equipment cabinets. The SSI shall provide all j-hooks to support the cables part of these components.
- N. Components of the distribution system shall be installed in a neat, workmanlike manner consistent with all best practices.
- O. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.
- P. Finger duct wire managers shall be used inside all equipment panels to properly dress cables.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified by pre-printed labels or tags. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. All cables shall be labeled at both ends of the cable with the same and unique identifier label.
- B. Cable and equipment identifiers shall follow a standard labeling system like TIA/EIA-606. The identification system chosen by the SSI shall be submitted for approval to the A&E.
- C. All access control panels, alarm panels, PLCs, or Intercom exchanges shall include a work sheet attached to the interior of the panel/ equipment in plastic envelops. This work sheet shall include the location, type of device and part number of all devices connected to the boards inside the equipment enclosure. All names used to identify devices in these worksheets shall match all names and identifiers used in the

software or the user interface of the system. A second copy of this worksheet shall be delivered to as part of the as-built information.

3.6 SECURITY SYSTEM PROGRAMMING

- A. Programming: It is the responsibility of the SSI to program all requested features in the access control system and the integration to other security systems. The programming responsibilities of the SSI include but not limited to:
1. Program all security doors to achieve the desired operation as described in this specification section. The SSI shall coordinate with the owner the door names and numbers, building names, room names and numbers to be used for the programming.
 2. Program all components of the system to achieve the functionality described in this specification.
 3. Program at least 5 access profiles for card holders and all access profiles for doors.
 4. Create at least 5 administrator profiles. The owner will program any additional card holder profiles required in the system.
 5. Program at least twenty five (25) users in the system. The SSI shall get this information from the owner. The owner will program all other users in the system.
 6. Program all required security features like macros and integration with other security modules like intercom and CCTV system.
 7. Program all interfaces with the elevator control systems.
 8. Program all GUIs in the system. The SSI shall use AutoCAD drawings to create all maps of the facility with the corresponding icons for control, operation and visualization of the security system. The SSI shall chose a scale for the drawings that allows all icons to be places without overlap and close enough to the actual physical location of the equipment in the map as to avoid ambiguity of the actual location of the devices. Nested maps shall be programmed to go from a complete building view to a detail zoned identifying all devices in the area.
 9. The SSI shall coordinate with the owner what alarms from the access control and intrusion alarm system are to be considered major alarms. All major alarms shall be programmed by the SSI to provide the operator detail information on the type of operating procedure expected during those alarms. All major alarms shall be programmed as to provide the operator and input field to type the response taken by the operator.
 10. All programming of remote monitoring features for the security system like telephone numbers to dial, reporting codes and alarm formats.
 11. All alarm messages and descriptive text of those messages shall be programmed.
 12. All zones for the intrusion alarm system shall be programmed into the system, coordinate with the owner on how they want this system configured,
 13. All devices and device names shall be programmed into the system, direction on the naming of these devices shall be obtained from the owner.
- B. DOOR INTERLOCKS: When indicated in the drawings, two doors that have a controlled door interlocks, the SSI shall program the security system is to provide the following functionality: While one door is opened the other door shall not be possible to be opened not by using a valid transaction at the reader neither by issuing a remote release command from the access control system.
- C. The SSI shall work with the owner during the programming of the system to fine tune all programming requirements of the system, as per owner's request. Fine tune is defined for this purpose as changing all field parameters available in the system, as specified, to complete software options available in the system. Fine tuning does not indicate adding additional software modules or additional hardware.

3.7 ADDITIONAL INSTALLER RESPONSIBILITIES

- A. Upon project commencement, the SSI shall provide qualified technical personnel on-site. Personnel shall be present on each consecutive working day until the system is fully functional and ready to begin the testing phase of this project.
- B. During the installation process the SSI shall maintain an up-to-date set of as-built shop drawings, which shall always be available for review by the client and/or consulting engineers. This set of documents should be clearly annotated with as-built data as the work is performed. These documents will be reviewed as part of the approval process when evaluating payment request applications. At a minimum, the drawings should contain the following information:
1. Quantity and location of all equipment installed.
 2. Cable and wire runs along with the designations tags assigned to each.
 3. Wiring diagrams that indicate terminal strip layout, identification, and terminations.

- C. The SSI Project Manager shall maintain continuous coordination with the A&E. The A&E shall be kept informed of the progress and all conflicts that arise during the course of this project. Prior to the start of construction the SSI shall submit a complete plan and schedule for proposed operations. This schedule should include information relevant to number of employees assigned to the project, work hours, etc.

3.8 REQUEST OF IP ADDRESSES

- A. The SSI shall comply with all requirements indicated in specification section 270500 for requesting IP address for the security system.

3.9 SYSTEM WARRANTY AND SERVICE

- A. General: The SSI shall follow all warranty and service requirements indicated in specification section 270500.

3.10 ENGINEER'S FINAL ACCEPTANCE TEST

- A. General: The SSI shall follow all test requirements indicated in specification section 270500.
- B. Additional requirements for the system acceptance test:
 - 1. The day of the final acceptance test the SSI shall have at least two (2) 2-way radios to communicate between the testing groups. Cell phones are not acceptable for communication since it takes too long to establish communication and will delay the test substantially. Radios shall be fully charged, and spare batteries shall be available for 8 hours of use.
 - 2. The final acceptance test will be done with two groups of people. Each group will have at least one member of each stakeholder of the project (A&E, Owner, SSI, General Installer/ Construction Manager). One group will be station in the monitoring room the other group will be going to all locations in the project where security equipment is installed.
 - 3. During the final acceptance test every single device in the security system will be tested for normal operation and for simulated alarm conditions at both ends (the field devices and in the monitoring room). When possible, security equipment will be tested for operation during main power failure. All features requested in this specification will be tested.
- C. Testing of all structured cabling system part of the Security System shall be done in accordance of specification section 271500

3.11 SPARE PARTS

- A. As part of this project the SSI shall provide the following spare parts:
 - 1. One (1) Intelligent System (ISC)
 - 2. One (1) Standard card readers
 - 3. One (1) Mullion mount card reader
 - 4. Two (2%) percent of all installed field devices, like local audible alarms, duress buttons, door position switches, tamper switches, request to exit motion sensors, etc.
 - 5. One (1) Power supply for electronic door locks.
 - 6. One (1) power supply for access control panels.
 - 7. One (1) surge protection devices of each type used on the project.
- B. A list of delivered spare parts shall be included with the close out information. This list shall indicate all components delivered and shall be signed received by the Owner. The name of person receiving the equipment shall be clearly written in the list and the date it was received.

3.12 TRAINING AND INSTRUCTION

- A. General: The SSI shall follow all training requirements indicated in specification section 270500.
- B. The SSI shall provide three (3) levels of training for this project as explained in this section.
- C. USER TRAINING
 - 1. User training shall be provided for security personnel interacting with the security system in areas different from the security monitoring rooms. The purpose of this training is to explain clearly how the field devices operate and what the different status indicators mean.
 - 2. This training shall cover operation of devices and doors like:
 - a. Operation and indication of all types of readers in the project
 - b. Resetting door alarms (local) for all door types.
 - c. Resetting of duress alarm buttons.
 - d. Operation of door interlocks

- e. Operation of the duress alarm notification system
 - 3. This training shall be provided by personnel working directly for the SSI.
 - 4. At least 2 separate sessions (on 2 different days) of this type of training shall be provided.
 - D. OPERATOR/ADMINISTRATION TRAINING
 - 1. Operator/Administration training shall be provided for security and IT personnel interacting with the security system in all security monitoring rooms. The purpose of this training is to explain clearly how the complete system operates and what the different status indicators mean.
 - 2. This training shall cover at least the following topics:
 - a. All content provided during the user training.
 - b. Operation of the Access control software (all aspects).
 - c. Operation of all devices inside the security monitoring room.
 - d. Alarm response and alarm reset in the security monitoring room
 - e. Data backup/restore and achieving.
 - f. File import/export.
 - g. Badging system operation (complete description)
 - h. Creating reports and print outs.
 - i. Basic system troubleshooting.
 - j. Creating users and password reset.
 - 3. This training shall be provided by personnel working directly for the SSI or a direct employee of the manufacturer of the system.
 - 4. This session shall last no less than 4 hours, broken down into day sessions no longer than 2 hours each.
 - 5. The approved O&M manuals shall be available at the time of the training.
 - E. MAINTENANCE TRAINING
 - 1. Maintenance training shall be provided for maintenance and IT personnel. The purpose of this training is to explain how to troubleshoot and replace all field devices and hardware.
 - 2. This training shall cover at least the following topics:
 - a. Trouble shooting and replacement of all field devices.
 - b. Installation of all field panels and settings (jumpers, dip switches, etc).
 - c. Wire labeling system.
 - d. Software system installation and recover from system crashes.
 - e. Detail explanation on all physical keys used in security devices.
 - f. Routine preventive maintenance procedures recommended by equipment manufacturers for all components of the system.
 - g. Detail explanation of source code programming for all devices that have software code specifically compiled for this project.
 - 3. This training shall be provided by personnel working directly for the SSI or a direct employee of the manufacturer of the system.
 - 4. This session shall last no less than 4 hours, broken down into day sessions no longer than 2 hours each.
 - 5. The approved O&M manuals shall be available at the time of the training.
- 3.13 AS-BUILT DOCUMENTS AND CLOSE OUT INFORMATION.
- A. General: The SSI shall follow all as built and close out information requirements indicated in specification section 270500
 - B. Additional requirements for as-built documentation shall include:
 - 1. Approved as-built drawings shall be a complete set of floor plans drawings, riser diagrams, and wiring details indicating the layout and interconnection of the system. All cable routings and elevation of each outlet, tie, and riser cable terminations shall be required.
 - 2. The content of the as-built information shall be no less than the content provided during the shop drawings, and shall be modified as per changes done during construction.
 - C. Close out information shall also include:
 - 1. Two (2) digital backups of all configuration files and databases part of the security system not earlier than the day after the final acceptance test is approved. These backups shall include a list of all the file names used and a complete description of the system that each file name belong to. The media for these backups shall be a compatible media that can be read by the computer system running the specific software program.

2. Testing reports for structured cabling system used for the Security system.

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SECTION 282000

CLOSED CIRCUIT TELEVISION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The scope of work shall include furnishing all labor, all security video cameras, mounts, housings, power supply systems, cabling, connectors and head end components, including all other hardware and software and documentation required to provide a completely operational and working Closed Circuit Television (CCTV) System.
- B. All materials for the structured cabling system (4-pair UTP cables, fiber optic cables and 24-AWG multi-pair 25 pairs or higher) components required for the video surveillance system shall be in compliance with specification Section 271500.
- C. The scope of work for this specification shall also include the following items:
 - 1. The programming of the CCTV software including the integration described in this specification, and interface to the existing headend.
 - 2. The supply, installation, and programming of the Intrusion Alarm system.
 - 3. The supply, installation, and programming of the site Emergency Assistance stations.
- D. The following parts of the system are not part of this contract:
 - 1. All networking equipment (switches, routers, etc) for the operation of the system. The CCTV contractor shall coordinate their network connection needs with the client's IT department to ensure all necessary connections are provided where required and in the quantity that is necessary. Ensure PoE needs are clearly identified during this coordination effort. If switches do not provide PoE injectors must be provided to support the equipment.
 - a. Exception: Industrial PoE network switches and media converters to support site security assistance stations and CCTV systems. This equipment is to be provided under this scope of work and basis of design is referenced on the plans.
 - 2. All computers and software to run the security headend systems with the exception of the items indicated in this specification.

1.2 RELATED DOCUMENTS

- A. General Terms and Conditions of the Contract Documents
 - 1. Division 26 – Electrical
- B. Supplemental: Refer to the specification sections identified below for additional requirements, which are supplemented by this section.
 - 1. 270500 Technology General Provisions
 - 2. 270526 Ground and Bonding for Communications Systems
 - 3. 270528 Raceways for Technology
 - 4. 271500 Structured Cabling System
 - 5. 281000 Electronic Security System

1.3 CCTV INSTALLER QUALIFICATIONS

- A. The Video Surveillance or CCTV installer (CI) selected for this project must be a direct representative of the products they intend to provide. All technicians assigned to install and configure this system shall be factory trained. This company must be of established reputation and experience, regularly engaged in the supply and support of such systems for a period of at least five consecutive years under the current company name. This company shall have a fully staffed office of sales and technical support representatives within 100 miles of this project.
- B. Other required CI qualifications are:
 - 1. The CI shall agree, in writing, as part of their proposal, to provide both warranty and non-warranty service within 4 hours of notification of a problem. The SSI shall be able to perform any and all repairs to the system within 24 hours.
 - 2. The CI shall submit as part of the qualifications required, the resume of the programmers for the access system as well as the training certificates for this staff from the manufacturer of the system.

1.4 MATERIALS ALTERNATES AND SUBSTITUTION

- A. General: See details for alternates and substitution in specification section 270500
- B. Due to compatibility issues with other buildings under the control of the owner, the only approved Digital Video Management System (DVMS) to be provided for this project is FLIR. No substitutions will be considered for this system.
- C. Cameras can be substituted as long as they have the same performance specification as the cameras used as basis of design and as long as they are supported by the DVMS. It is the responsibility of the CI to verify and assure the cameras proposed as substitution are supported by the DVMS. Any cost associated with certifying a proposed camera to the DVMS to be used in this project shall be covered by the CI.

1.5 SHOP DRAWINGS AND SUBMITTALS

- A. The CI shall follow all requirements for shop drawings indicated in specification section 270500
- B. The submittal process for this scope of work will be a two-stage process. The first stage is the product/installer approval. Within 30 business days of receiving contract approval and notice to proceed, the following items shall be submitted to the Owner, Architect, Engineer, or other designated representatives, for review and approval.
 - 1. Proof of Installer qualifications, addressing all requirements of paragraph 1.3 of this specification.
 - 2. Product numbers, specifications, and data sheets for all equipment.
 - 3. Data sheets and samples of all labeling materials and equipment to be used in the project.
 - 4. A complete explanation of the identification method to be used for all equipment and cabling part of the CCTV system.
 - 5. Data sheets of all termination blocks and mounting accessories to be used in the project. A paragraph shall be added before each data sheet indicating the intended use of each type of termination block.
 - 6. Detailed drawings of all custom products to be used in the project.
 - 7. Data sheets for all wire and cable to be used as part of this system. A paragraph shall be added before each data sheet indicating the intended use (to connect what type of devices) of each cable.
- C. The second stage of the submittal process is the shop drawing process. Shop drawings shall only be submitted after all portions of the product/installer approval have been accepted by the Owner, Architect, Engineer, or other designated representatives. The following information is required as part of the shop drawings:
 - 1. Floor plans indicating all devices to be provided and all cable runs to all devices or junction boxes. All cameras shall indicate the camera number in the system and the type of camera and mounting.
 - 2. Point to point wiring diagrams indicating all termination points for each conductor and for each device, cable types and color coding of each termination. These diagrams shall be submitted for each camera type.
 - 3. Storage calculation. The CI shall provide a spreadsheet with all the cameras in the project and the proposed recording frame rates, resolutions, activity percentages and times of recording with the total number of storage bytes per camera and a total for the system. The total storage capacity shall be indicated in Terabytes.
 - 4. Bandwidth calculation. The CI shall provide a network bandwidth calculation for the system. This calculation shall be presented in the form of a spreadsheet using MBPS as the units listing all cameras in the project. The spreadsheet shall have subtotals per network region associated with a storage area.
 - 5. Video recording server assignment. A list of all the video servers to be provided in the project with a list of all cameras assigned to each server. Each server shall have a total bit rate estimated for all the cameras recorded showing that the capacity requirements of the server comply with the requirements in this specification.
 - 6. Panel schedules in a table format, indicating all ports being used and what device is connected to each port. Panel schedules shall be submitted for all camera power supply, multiport encoder/decoders, computer monitor outputs, fiber optics distribution frames, Ethernet switches, patch panels, termination blocks, etc.
 - 7. Overall system diagrams indicating all head end components, their room location, and all configuration characteristics like IP addresses, serial ports used, etc.
 - 8. Outline of the testing process.
 - 9. Training syllabus for all systems included in this scope.

1.6 ABBREVIATIONS

- A. The following abbreviations are used in this document:

1. API - Application Programming Interface
2. ASCII - American Standard Code for Information Interchange
3. BPS - Bits Per Second
4. DGM - Dynamic Graphical Maps
5. FCC - Federal Communications Commission
6. GUI - Graphical User Interface
7. HDMI - High Definition Multimedia Interface
8. ID - Identification
9. I/O - Input /Output
10. IPS - Images Per Second
11. LPR - License Plate Recognition camera
12. MBPS - Mega Bits per Second
13. NTP - Network Time Protocol
14. NTSC - National Television Standard Committee
15. ODBC - Open Database Connectivity
16. ONVIF - Open Network Video Interface Forum
17. O&M - Operations and Maintenance
18. PAL - Phase Alternating Line
19. PIN - Personal Identification Number
20. PTZ - Pan/Tilt/Zoom
21. RAID - Redundant Array of Independent Disks
22. RoHS - Restriction of Hazardous Substances Directive
23. SDRAM - Synchronized Dynamic Random Access Memory
24. STP - Shielded Twisted Pair
25. TCP/IP - Transmission Control Protocol/Internet Protocol
26. UL - Underwriters Laboratories, Inc.
27. UPS - Uninterrupted Power Supply
28. USB - Universal Serial Bus
29. UTP - Unshielded Twisted Pair
30. VOC - Volatile Organic Compounds

1.7 SYSTEM DESCRIPTION

- A. The CCTV system shall be a TCP/IP network-based, fully distributed digital video system. The CCTV system will utilize local area networks (LAN) as a transmission medium for video, configuration, as well as storage of all data. The CCTV system shall provide full video control at the management point indicated in the design drawings, with additional full selection capability at any point within the network from a computer workstation. The CCTV system shall provide unlimited expansion capability for the addition or modification of any video device or computer workstation.
- B. The CCTV system shall permit normal and event monitoring of all secured areas on digital monitors as required or shown in the specifications and drawings. In all cases, the equipment shall be state of the art, standardized commercial off-the-shelf, and modular. In all cases, the method of communication from remote locations within the network to the central components shall be transparent to the user. Equipment shall be selected and installed so repairs may be accomplished on site by module replacement, utilizing spare components whenever possible.
- C. The intent of this specification is to provide the owner with a distributed networked digital security system. Supplied by the CI, the CCTV system shall be complete and operational per the performance requirements and objectives of these specifications. The CI shall be responsible for the coordination of related work with other trades affecting his/her work or the work of others.
- D. The CCTV System shall be fully integrated with other security components such as access control, alarm monitoring and intercom communications. The system shall be fully integrated with the access control application to allow events to be directly linked to the CCTV surveillance recording system. See specification section 281000 for details of the integration scope of work and the performance required.
- E. All cameras shall be connected and controlled through a CCTV workstation utilizing a standard mouse and keyboard.

PART 2 - PRODUCTS

2.1 CCTV VIDEO MANAGEMENT SYSTEM

- A. The following security manufacturer has been used as the basis for design:

1. FLIR Latitude – Digital Video Management System (DVMS), confirm release/version in use.
 2. License as required for each cctv camera.
 3. (1-year) advantage support license for each camera, from date of final acceptance.
- B. This system is monitored remotely from the clients existing security command center, only cameras and camera licenses are required under this scope of work. The client shall provide any and all required expansion hardware components for cctv recording. The integrator shall provide all system configurations to interface new equipment to existing headend systems.
- C. Use of this system(s) does not release the SSI from submittal requirements defined herein, all submittals must conform to applicable sections of this specification.
- D. The FLIR Latitude VMS & CCTV camera systems are the established standard for this client, substitutions for these system will not be considered.
- E. The SSI shall provide all licenses for this system that are required for the addition of new cameras.
- 2.2 VIDEO MANAGEMENT SYSTEM - GENERAL REQUIREMENTS
- A. All video streams supplied shall be digitally encoded in H.265, H.264, MPEG-4, MPEG-2, MJPEG, MxPEG, Wavelet, or JPEG2000 compression formats and recorded simultaneously in real time.
- B. Each camera's bit rate, frame rate, and resolution shall be set independently from other cameras in the system and altering these settings shall not affect the recording and display settings of other cameras.
- 2.3 DIGITAL VIDEO MANAGEMENT SYSTEM SOFTWARE
- A. The CI shall provide all software required for the addition to the video surveillance system.
- B. The digital video management system shall be composed of management servers, storage system and the DVMS software. The storage system shall be composed of DVMS management server, DVMS recording servers, storage arrays, and storage expansion units.
- C. The DVMS recording servers shall process all video streams for recording, live viewing, and playback for the cameras assigned to that recorder. Servers shall be provided in quantities as to not any single server being used at more than 75% of the maximum bit rate capacity of the server. The SSI must provide any software or hardware upgrades required to meet these standards.
- D. The storage arrays and storage expansion shall provide a network attached storage medium for the video servers.
- E. The network storage manager chassis shall be designed for video surveillance recording applications and encompass redundancy at all vital points:
1. Hot swappable O/S drive
 2. Hot swappable Storage Drives
- F. At a minimum the video surveillance system software shall provide the following key features:
1. Ability to see live video and recorded video in the same application software.
 2. Ability to export video to an open standard file like AVI files
 3. Ability to integrate with other system with features as indicated in this specification.
 4. Support browser based clients and standard client workstation.
 5. Have video analytics incorporated into the DVMS.
- G. The Digital Video Management System shall be FLIR Latitude.
- 2.4 360 DEGREE MULTI-SENSOR IP CAMERA WITH IR ILLUMINATION
- A. The Quad HD megapixel camera must have True (Shutter) Wide Dynamic Range (WDR) with an integrated infrared (IR) illuminator and auto-focusing, motorized varifocal lens for installation into a fully operational video system. The camera shall support multiple high-resolution, high-frame-rate streams optimized for the orientation in which it is installed:
1. The camera shall provide the user with four Ultra-HD images, giving 360-degree coverage of the area around it.
- B. The camera shall provide True day/night (ICR), True (Shutter) Wide Dynamic Range (WDR), H264, H265 and MJPEG compression, in a vandal-proof enclosure with integrated infrared (IR) illumination for installation into a fully operational digital video system. This Specification is part of a larger project which may be covered in one or more of the Specification sections listed below.

- C. The camera shall support to 4K (4 x 1080p image sensors), triple-stream H.265/H264/MJPEG, True (Shutter) WDR support, IP67-rated, day/night mini-dome digital video camera with fixed F2.0, 3.6mm lens, within an IK10 vandal-resistant housing for overhead mounting or side orientation mounting, designed so that the same unit can be deployed with 360 or 180 mode orientations.
 - D. The camera shall be equipped with sensors and lenses that are field configurable.
 - E. The camera should provide up to five simultaneous single streams (with resolutions and frame rates selected by the user from the available options) containing four images, one in each direction.
 - F. The camera shall provide bi-directional audio via audio I/O. The audio capabilities shall support either half-duplex or full-duplex audio on two-way connections.
 - G. The camera shall accommodate alarm inputs and provide a relay output.
 - H. The camera shall provide a microSDXC card slot with support for up to 128GB (Class 10) devices.
 - I. The camera shall be IEEE-compliant utilizing the multicast networking protocol such that a single camera may be transmitted to multiple viewers/archivers on the network simultaneously, further reducing bandwidth and providing greater flexibility in network monitoring/recording configurations.
 - J. The digital video camera shall provide the user with H.265 and H.264 video compression on up to three digital streams simultaneously. Resolution shall be scalable dependent on operation mode, from D1 to 4K/3840x1440 which may be set to unicast or multicast. The camera shall be capable of producing 30 frames per second (NTSC) and/or 25 frames per second (PAL) 4K Ultra HD (3840 x 2160) video stream. The camera shall be capable of producing (NTSC) or (PAL) Full HD / 1080P (1920 x 1080) video stream at 30 frames per second.
 - K. Cameras shall be indoor/ outdoor rated and vandal resistant. The camera housings shall be IK10 and IP67 rated. The cameras shall support 802.3at PoE+, 24VAC. Power consumption shall be 24.9W with heater and IR on. Operating temperature shall be -40 to 122 degree F.
 - L. The camera shall be provided with the appropriate accessories for mounting in recessed applications, wall, corner, pendant, pole, or parapet locations as indicated on the drawings. Mounting accessories shall also be compatible with other cameras provided by the same vendor.
 - M. The camera system for the Multi-sensor IP camera dome system shall meet or exceed the following design and performance specifications:
 - 1. Image Sensor: (4) x 1/2.8" CMOS sensor
 - 2. Effective Pixels: (4) 1920 x 1080 x 2MP sensors
 - 3. Lens: (4) f2.0, 3.6mm fixed lens, with automatic day/night and wide dynamic range (WDR).
 - 4. IR illumination shall have a range of 82-feet (25m).
 - N. Design selection: The 360-degree multi-sensor camera shall be FLIR Quasar CM-63-08-P360-1.
- 2.5 FIXED MINI DOME IP CAMERA WITH IR ILLUMINATION
- A. The camera shall be Full HD (1080p) True (Shutter) Wide Dynamic Range (WDR) mini-dome IP camera with an integrated infrared (IR) illuminator and auto-focusing, motorized vari-focal lens for installation into a fully operational digital video system.
 - B. The camera shall support H.265/H264/MJPEG. The camera shall have a motorized varifocal lens 2.7 ~ 13.5mm, F1.4, D/N, with auto-focus and auto-iris. The image sensor shall be a 1/2.8" Sony Progressive Scan DOL 2F CMOS with a resolution of 1920 x 1080 pixels.
 - C. The cameras shall support color mode at 0.02 lux @ 30 IRE and night mode at 0.01 lux without IR, 0 lux with IR @ 30 IRE. The camera shall have an effective IR range: of (30 m) 98 ft.
 - D. The camera shall provide a microSDXC card slot with support for up to 256GB (Class 10) devices.
 - E. The camera shall be IEEE-compliant utilizing the multicast networking protocol such that a single camera may be transmitted to multiple viewers/archivers on the network simultaneously, further reducing bandwidth and providing greater flexibility in network monitoring/recording configurations.
 - F. The digital video camera shall support H.265 and H.264 video compression. Resolution shall be scalable dependent on operation mode, from D1 to 1080p and may be set to unicast or multicast. The camera shall be capable of producing 30 frames per second (NTSC) and/or 25 frames per second (PAL).
 - G. Cameras shall be indoor/ outdoor rated and vandal resistant. The camera housings shall be IK10 and IP67 rated. The cameras shall support 802.3af PoE, 12VDC. Power consumption shall be 24.9W with heater and IR on. Operating temperature shall be -22 to 140 degree F.

- H. The IP dome camera shall be provided with the appropriate accessories for mounting in recessed applications, wall, corner, pendant, pole, or parapet locations as indicated on the drawings. Mounting accessories shall also be compatible with other dome cameras provided by the same vendor.
- I. The fixed megapixel mini-dome network camera with auto day/ night low-light and IR illumination shall be the FLIR ARIAL CM-3202-1-1-I camera.

2.6 FIXED BULLET TYPE IP CAMERA

- A. The fixed camera shall have True (Shutter) Wide Dynamic Range (WDR) with an integrated infrared (IR) illuminator and auto-focusing, motorized vari-focal lens for installation into a fully operational digital video system.
- B. The camera shall support H.265/H264/MJPEG. The camera shall have a motorized varifocal lens 2.8 ~ 8.5mm F1.2 or 9 ~ 22mm F1.5 lens with auto-focus and auto-iris. The image sensor shall be a 1/2.9" Progressive Scan BSI CMOS SENSOR with a resolution of 2560 x 1440 pixels.
- C. The cameras shall support color mode at 0.07 lux @ 30 IRE and night mode at 0.01 lux without IR, 0 lux with IR @ 30 IRE. The camera shall have an effective IR range: of (30 m) 98 ft.
- D. The camera shall provide a microSDXC card slot with support for up to 128GB (Class 10) devices.
- E. The camera shall support an operating temperature range of -40°F to 122°F (-40°C to 50°C) with 10% - 100% relative humidity (condensing). The exterior camera shall be manufactured with IP66 and NEMA-4 rated, IK-10 impact resistant casings
- F. The fixed bullet style network camera with auto day/ night low-light and IR illumination shall be the FLIR ARIAL CB-33-04-1-1-I (2.8 ~ 5mm) or CB-33-04-2-1-I (9 ~ 22mm) camera.

2.7 CAMERA MOUNTS AND DOME MOUNTS

- A. Camera, enclosures and dome mounts shall be provided as shown in the design drawings. The SSI shall choose the mounts based on the equipment being supported. All mounts shall be made by the same manufacturer of the cameras. Custom made mount are not acceptable, unless approved by the A&E.
- B. All camera mounts and dome mounts shall me made of steel, aluminum or stainless steel. Plastic mounts are not acceptable. Outdoor rated mounts shall be used for outdoor cameras, and indoor rated mounts shall be used for indoor cameras.

2.8 NETWORK ELECTRONICS

- A. All active network electronics such as switches and routers shall be provided by the Owner. The security contractor shall coordinate their network connection needs with the clients IT department to ensure all necessary connections are provided where required and in the quantity that is necessary. Ensure PoE needs are clearly identified during this coordination effort. If switches do not provide PoE injectors must be provided to support the equipment.
- B. The contractor shall coordinate IP address needs with the clients IT department for assignment of network addresses and other conventions, standards, and protocols.
- C. Industrial network electronics for site security, intercom, and cctv systems are required under this scope of work, reference site plan for additional information on this equipment.

2.9 NETWORK CABLING

- A. All network Category 6A cabling required to support the CCTV system between the communication room and camera shall be provided by the Structured Cabling Contractor (SCS). The CCTV contractor shall be responsible for providing all certified patch cords between the camera and this jack. Additionally, under this scope of work, within the communication rooms and between hardware in the equipment racks, the contractor shall provide & install this cabling. On exterior pole-mounted cameras the contractor shall provide and install all network & fiber optic cabling PoE network modules and the camera. Low voltage power cabling is the contractor's responsibility where required as are the NEMA-4X 316 stainless steel enclosures to house this equipment.

2.10 FIBER OPTIC CABLING

- A. All fiber optic cabling required to support the CCTV system as shown on the site plan drawings shall be provided by the Structured Cabling Contractor (SCS). All fiber optic patch cords between the fiber distribution cabinets and fiber optic transmitters and receivers shall be provided as required to support this system. Reference site plan and riser details for quantities of required fiber optic cabling.

2.11 SURGE PROTECTION

- A. All CCTV components mounted outside the building shall be provided with surge and lightning protection. Provide UL listed multi-stage protection on all low voltage and signal transmission lines. All 120 VAC surge suppression devices shall be Emerson/ EDCO HSP121BT-1RU or an approved equal. For low voltage connections provide FAS-1 surge suppressors manufactured by Emerson/ EDCO or an approved equal. For coax connections provide CX-06-BNCY line protectors manufactured by Emerson/ EDCO or an approved equal.
- B. For exposed Ethernet connections with PoE, use Emerson/ EDCO CAT6-E PoE or approved equal.

2.12 WIRE & CABLE

- A. Cables for PoE over coax transmission for elevators cameras, (less than 750 ft.), shall have the following specification:
 - 1. Minimum cable gauge: AWG 20.
 - 2. Number of conductors: 1 solid coaxial cable
 - 3. Conductor type: Bare copper
 - 4. Cable insulation: Foam polyolefin
 - 5. Nominal Impedance: 75 Ohms, RG-59
 - 6. Cable shield: 95% bare copper braid.
 - 7. Aluminum shielded CATV coax cable is not acceptable for this requirement.
- B. Cables for PoE over coax transmission for elevators cameras (less than 10 ft.) shall have the following specification:
 - 1. Minimum cable gauge: AWG 25.
 - 2. Number of conductors: 1 solid coaxial cable
 - 3. Conductor type: Bare copper
 - 4. Cable insulation: Foam polyolefin
 - 5. Nominal Impedance: 75 Ohms, mini-RG-59
 - 6. Cable shield: 95% bare copper braid.
 - 7. Aluminum shielded CATV coax cable is not acceptable for this requirement.
- C. Cables for PTZ control, RS-422 or RS-485 control lines shall have the following specifications:
 - 1. Minimum cable gauge: AWG 24
 - 2. Number of conductors: 2-paired, stranded conductors
 - 3. Conductor type: Tinned copper
 - 4. Cable insulation: Polyethylene
 - 5. Conductor insulation colors: White-blue, blue-white white-orange and orange-white
 - 6. Voltage rating: 300V
 - 7. Cable shield: Aluminum/polyester foil (overall), a tinned copper braid (90% coverage) and a AWG 24 tinned copper drain wire
 - 8. Nominal characteristic impedance: 120 Ohms
 - 9. Nominal capacitance: 12.8 pF/ft.
 - 10. Nominal delay: 1.6 ns/ft.
 - 11. Nominal attenuation: 0.6 dB/100 ft @ 1 MHz.
- D. Cables for camera power supply shall have the following specifications:
 - 1. Minimum cable gauge: AWG 18
 - 2. Number of conductors: 2, stranded conductors
 - 3. Conductor type: Bare copper
 - 4. Cable insulation: PVC
 - 5. Conductor insulation colors: Black and red.
 - 6. Voltage rating: 300V
 - 7. Cable shield: No cable shields
 - 8. HDMI or DVI cables shall be factory made and tested cables. For all DVI connections use an HDMI cable with HDMI to DVI adapters. All HDMI cables shall be capable of passing a signal at 340 MHz,
- E. All UTP Category horizontal cables and fiber optic cables for the CCTV system shall be in compliance of all requirements in specification section 271500 and shall be under the same warranty as all UTP category cables and fiber optic cables described in specification section 271500. Color jacket for wiring for the CCTV system shall be (Orange).
- F. Cable gauge: All cable gauges shall be estimated as to allow a maximum of 5% voltage drop from the source to the load. Sizes given previously are only minimum gauges accepted. The Installer shall always estimate proper values.

- G. Cable jackets: All cable jackets shall be suitable for the environment in which the cables will be installed. Use plenum rated cables when cables are installed in plenum spaces. Use riser rated cables when cables are installed through floor sleeves. Use cable jackets with water-blocking material when installed in underground conduits.
 - H. Cable jackets for this project: Except when cables are run continuously in conduit all cable or patch cord cables; jackets for CCTV cables shall be plenum rated.
 - I. All cables shall be RoHS compliant and free of VOC. The SSI shall provide proof of compliance for all cables during the submittal process.
 - J. Acceptable manufacturers: Belden, Alpha Wire Company, General Cable and West Penn Wire.
- 2.13 IDENTIFICATION AND LABELING TAGS
- A. The CI shall follow labeling materials indicated in specification section 270500. All cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified by pre-printed labels or tags. Direct ink markings on the cable shall not be acceptable. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. Schematic legends shall be placed inside all terminal cabinets to assist with identification. Reference additional requirements under part-3 of this specification
 - B. The CI shall follow labeling materials indicated in specification section 270500.

PART 3 - EXECUTION

3.1 INSTALLATION PRACTICES

- A. General: The CI shall follow all installation practices indicated in specification section 270500

3.2 WIRING METHODS

- A. All proposed wire and cable shall meet or exceed the recommendations established by the equipment manufacturers, and shall comply with all state and local codes.
- B. Visually inspect all wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps.
- C. Provide grommets and strain relief materials where necessary to avoid abrasion and excess tension on wire and cable.
- D. All penetrations through fire rated barriers shall be provided, by the CI, with appropriate fire stopping materials in accordance with NFPA requirements and local fire authority having jurisdiction.
- E. All cable runs shall be continuous from the device to the equipment. Cable splices shall not be allowed inside conduits, or cable trays.
- F. All cameras shall have a camera interface box with disconnect means to horizontal cabling for testing purposes and service. Camera interface boxes shall be located in accessible ceiling spaces as close as possible to the camera. Disconnect means shall be provided for UTP cables in the form of an 8-pin modular plug and receptacle. Disconnect means shall be provide for low voltage camera power cables in the form of insulated spade connectors (female connectors in load side, male connectors in camera side).
- G. All video cable connectors and terminations shall be 3-way crimp-on type and shall including connector cables for 24 VAC input and video/data coax output. Twist on style connectors will not be acceptable for any terminations on this project.
- H. Cables of similar signal level shall be bundled together and kept physically separate from power cords, plug strips or other circuits with different potential. Exposed wire bundles or individual cables shall be neatly secured with self-clinching nylon "TY Raps" (Thomas & Betts or equal). Lacing of cables shall not be permitted.
- I. All cables run part of the CCTV system in areas where ceiling is not accessible or in building exterior shall be in conduit at all times
- J. All termination of UTP Category type multi pair cables shall be done in Insulation Displacement Connectors (IDC), modular plugs or connectors. The use of wire nuts or manually twisting cables and protecting them with electrical tape are not acceptable means of termination.
- K. Components of the distribution system shall be installed in a neat, workmanlike manner consistent with all best practices.

- L. Wiring color codes shall be strictly observed and terminations shall be uniform throughout the building.

3.3 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks, and terminals shall be clearly identified by pre-printed labels or tags. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. All cables shall be labeled at both ends of the cable with the same and unique identifier label.
- B. Cable and equipment identifiers shall follow a standard labeling system like TIA/EIA-606. The identification system chosen by the CI shall be submitted for approval to the A&E.
- C. All camera power supplies, patch panels shall include a work sheet attached to the interior of the equipment cabinet in plastic envelopes. This work sheet shall include the location, type of device and part number of all devices connected to the boards inside those equipments. All names used to identify devices in these worksheets shall match all names and identifiers used in the software or the user interface of the system. A second copy of this worksheet shall be delivered to as part of the as-built information.

3.4 CCTV SYSTEM PROGRAMMING

- A. The CI shall program the CCTV system and the integration to the Security System as indicated in specification section 281000.
- B. IP Video Management System (IPVMS) programming: The CI is responsible for all programming and installation labor associated with the IPVMS and the CCTV workstations, as well as all components to make the system operational. The CI shall program the IPVMS system as to create the minimum amount of traffic in the network, and still comply with all resolutions and frame rates as indicated in this specification.
- C. IP video frame rate setting: The CI shall program all settings for the IPVMS following these criteria:
 - 1. The system shall be programmed for 2 different modes of operation: high activity mode and low activity mode. The CI Installer shall work with the owner to establish in a regular week for each area of the building what hours in each day are considered high activity and what hours of each day are considered low activity.
 - 2. All cameras in low traffic interior non-public hallways or rooms shall be recorded normally at 2fps @ highest resolution during high activity mode. During high activity mode frame rate shall be increased to 15 fps upon motion detection or alarm from access control system in the field of view for at least 5 minutes after motion ceased or alarm cleared. During low activity mode these cameras shall be recorded at 1 fps. Upon motion detection in the field of view of those cameras, the frame rate shall be increased to 15 fps @ highest resolution for at least 5 minutes after motion ceased.
 - 3. All cameras in public areas inside the building shall be recorded at least at 15 fps @ highest resolution during high activity mode. During low activity mode cameras in these areas shall be recorded at 4 fps. Upon motion detection in the field of view of those cameras, the frame rate shall be increased to 15 fps @ highest resolution for at least 5 minutes after the motion ceased.
 - 4. All site and exterior cameras shall be recorded at 15 fps @ highest resolution at all times.

3.5 ADDITIONAL INSTALLER RESPONSIBILITIES

- A. Upon project commencement, the CI shall provide qualified technical personnel on-site. Personnel shall be present on each consecutive working day until the system is fully functional and ready to begin the testing phase of this project.
- B. During the installation process the CI shall maintain an up-to-date set of as-built shop drawings, which shall always be available for review by the client and/or consulting engineers. This set of documents should be clearly annotated with as-built data as the work is performed. These documents will be reviewed as part of the approval process when evaluating payment request applications. At a minimum, the drawings should contain the following information:
 - 1. Quantity and location of all equipment installed.
 - 2. Cable and wire runs along with the designations tags assigned to each.
 - 3. Wiring diagrams that indicate terminal strip layout, identification, and terminations.
- C. The CI Project Manager shall maintain continuous coordination with the consulting engineers. The engineers shall be kept informed of the progress and all conflicts that arise during the course of this project. Prior to the start of construction the CI shall submit a complete plan and schedule for proposed operations. This schedule should include information relevant to number of employees assigned to the project, work hours, etc.

3.6 REQUEST OF IP ADDRESSES

- A. The CI shall comply with all requirements indicated in specification section 270500 for requesting IP address for the security system.

3.7 SYSTEM WARRANTY AND SERVICE

- A. General: The CI shall follow all warranty and service requirements indicated in specification section 270500.

3.8 ENGINEER'S FINAL ACCEPTANCE TEST

- A. General: The SSI shall follow all test requirements indicated in specification section 270500.
- B. Additional requirements for the system acceptance test:
 - 1. The day of the final acceptance test the CI shall have at least two (2) 2-way radios to communicate between the testing groups. Cell phones are not acceptable for communication since it takes too long to establish communication, and will delay the test substantially. Radios shall be fully charged, and spare batteries shall be available for 8 hours of use.
 - 2. The final acceptance test will be done with two groups of people. Each group will have at least one member of each stakeholder of the project (A&E, Owner, SSI, General Installer/ Construction Manager). One group will be station in the monitoring room the other group will be going to all locations in the project where security equipment is installed.
 - 3. During the final acceptance test every single camera will be tested in the system. When possible, CCTV equipment will be tested for operation during main power failure. All features requested in this specification will be tested
- C. Testing of all structured cabling system part of the Video Surveillance system shall be done in accordance with specification section 271500

3.9 SPARE PARTS

- A. As part of this project the SSI shall provide the following spare parts:
 - 1. One (1) camera of each type in the project. Electronics only, no enclosures
 - 2. One (1) additional surge suppression of each type used in the project.
- B. A list of delivered spare parts shall be included with the close out information. This list shall indicate all components delivered and shall be signed received by the Owner. The name of person receiving the equipment shall be clearly written in the list and the date it was received.

3.10 TRAINING AND INSTRUCTION

- A. General: The CI shall follow all training requirements indicated in specification section 270500.
- B. The CI shall provide two (2) levels of training for this project as explained in this section.
- C. OPERATOR/ADMINISTRATION TRAINING
 - 1. Operator/Administration training shall be provided for security and IT personnel interacting with the CCTV system in all security monitoring rooms. The purpose of this training is to explain clearly how the complete system operates and what the different status indicators mean.
 - 2. This training shall cover at least the following topics:
 - a. Operation of the CCTV system software (all aspects).
 - b. Operation of all devices inside the security monitoring room.
 - c. Alarm response and alarm reset in the security monitoring room
 - d. Data backup/restore and achieving.
 - e. File import/export.
 - f. Creating reports and print outs.
 - g. Basic system troubleshooting.
 - h. Creating users and password reset.
 - 3. This training shall be provided by personnel working directly for the CI or a direct employee of the manufacturer of the system.
 - 4. This session shall last no less than 4 hours, broken down into day sessions no longer than 2 hours each.
 - 5. The approved O&M manuals shall be available at the time of the training.
- D. MAINTENANCE TRAINING

1. Maintenance training shall be provided for maintenance and IT personnel. The purpose of this training is to explain how to troubleshoot and replace all field devices and hardware.
 2. This training shall cover at least the following topics:
 - a. Trouble shooting and replacement of all field devices.
 - b. Installation of all cameras and their settings (jumpers, dip switches, etc).
 - c. Wire labeling system.
 - d. Software system installation and recover from system crashes.
 - e. Detail explanation on all physical keys used in CCTV devices.
 - f. Routine preventive maintenance procedures recommended by equipment manufacturers for all components of the system.
 - g. Detail explanation of source code programming for all devices that have software code specifically compiled for this project (i.e. the control system for the video wall).
 3. This training shall be provided by personnel working directly for the CI or a direct employee of the manufacturer of the system.
 4. This session shall last no less than 4 hours, broken down into day sessions no longer than 2 hours each.
 5. The approved O&M manuals shall be available at the time of the training.
- 3.11 AS-BUILT DOCUMENTS AND CLOSE OUT INFORMATION
- A. General: The CI shall follow all as built and close out information requirements indicated in specification section 270500
 - B. Additional requirements for as-built documentation shall include:
 1. Approved as-built drawings shall be a complete set of floor plans drawings, riser diagrams, and wiring details indicating the layout and interconnection of the system. All cable routings and elevation of each outlet, tie, and riser cable terminations shall be required.
 2. The content of the as-built information shall be no less than the content provided during the shop drawings, and shall be modified as per changes done during construction.
 - C. Close out information shall also include:
 1. Two (2) digital backups of all configuration files and databases part of the CCTV system not earlier than the day after the final acceptance test is approved. These backups shall include a list of all the file names used and a complete description of the system that each file name belong to. The media for these backups shall be a compatible media that can be read by the computer system running the specific software program.
 2. Testing reports for structured cabling system used for the CCTV system.

END OF SECTION

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