

May 3, 2024

Field House Locker Room Build-Out @ Auburn High School



RPS 205 IFB #24-59
RPS 205 PROJECT #2414
Architect Project # C2006



HAGNEY ARCHITECTS, LLC
4615 E. State Street, Suite 206
Rockford, IL 61108
815-397-3330

BID OFFER FORM

RPS Project # 2414

IFB # 24-59 FIELD HOUSE LOCKER ROOMS @ Auburn High School

BID SUBMITTED BY: _____

Date: _____

The undersigned, having become familiar with the local conditions affecting cost of work and with the Bidding Documents, including the advertisement of the Invitation for Bid, the Instructions and Supplementary Instructions to Bidders, this Bid Offer Form, the General and Supplementary Conditions, the Drawings and Specifications, and Addenda issued thereto, as prepared and issued by the Board of Education of Rockford School District No. 205, Winnebago and Boone Counties, Illinois hereby agrees to furnish all labor, material and equipment necessary to do the Work required for the project and IFB identified above, for the amount shown below:

BASE BID:

For All Work shown on the Drawings and specified in the Bidding Documents, the total of:

_____ DOLLARS (\$_____)

ADDENDA RECEIVED

The undersigned acknowledges receipt of Addenda _____ to _____ inclusive.

PRE-BID MEETING ATTENDANCE

A Bidder representative attended the Pre-Bid Meeting? YES _____ OR No _____

SITE VISIT

Existing premises and conditions were checked by an on-site inspection on (date) _____

CONTRACTOR'S QUALIFICATION STATEMENT

A fully completed AIA Document A305-1986 Contractor's Qualification Statement is **required** AND MUST BE SUBMITTED WITH THE BID. Include at least three references from projects completed in the past five (5) years with phone number, date of completion, description of work, and project architect (or engineer) contact name with phone number. Projects must be similar to the scope of this bid, and the bidder must have acted in the capacity of prime or general contractor.

Contractor has adequate equipment to perform the work properly and expeditiously: YES _____ OR No _____

COMMENCEMENT AND COMPLETION OF CONTRACT

The undersigned agrees, if awarded the Contract, to commence the contract work within five (5) days of receipt of Order to Proceed or if required, upon execution of a formal written contract and to complete said Work within the specified completion time. The undersigned further agrees to execute the Contract, furnish satisfactory performance and payment bond as well as insurance coverage, as specified in strict accordance with the Contract Documents.

BASE BID WORK

Date of Commencement of Construction: _____

Date of Substantial Completion: _____

Date of Final Completion: _____

BIDDER: _____

(Corporation) (Partnership) (Individual) Circle One

Address _____

Street

City

State

Zip Code

Phone No.

Email address

BIDDER FEIN/SSN NO. _____

By: _____

Bidder or Authorized Agent Signature

Print name

Title: _____

Subscribed and sworn to before me this ____ day of _____, _____.

Notary Public

My commission expires: _____

BID DEPOSIT CERTIFICATION

A Bid Deposit is required in the amount of 5% of the total Bid including Alternate Bids. This Bid Deposit is to be a Bid Bond, Bank Draft or Certified Check made payable to the "Rockford School District No. 205", as a guarantee that if awarded all or part of the Bid, the firm will enter into a contract to perform with the Board of Education.

Amount of Total Bid \$ _____

Amount of Bank draft or Certified Check \$ _____

BIDDER: _____

Signature of Bidder or Authorized Agent

SUBCONTRACTOR LISTING

Pursuant to bidding requirements for the Work:

The Bidder, for portions of the Work equaling or exceeding ½ of 1% of the total Contract Sum, proposes to use the following Subcontractors. The Bidder proposes to perform all other portions of the Work with its own forces. The District reserves the right to qualify all Subcontractors. COPY AND ATTACH ADDITIONAL SHEETS AS NECESSARY.

<u>Portion of the Work</u>	<u>Subcontractor Name and Address</u>
_____	_____

_____	_____

_____	_____

_____	_____

Bidder:

By: _____
Bidder or Authorized Agent Signature

END OF BID OFFER FORM

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Owner-furnished/Contractor-installed (OFICI) products.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls", **and the School District's "Supplementary Conditions" for limitations and procedures governing temporary use of Owner's facilities.**

1.2 PROJECT INFORMATION

A. Project Identification: **Field House Locker Rooms @ Auburn High School.**

Location of Work:

1. Auburn High School – 5110 Auburn Street, Rockford, Illinois, 61101.

B. Owner: Rockford Public School District 205.

C. Architect: HAGNEY ARCHITECTS, LLC, 4615 E. State St., Suite 206, Rockford, IL 61108.

1. Architect's Representative: Frank St. Angel.
2. Tel. 815-397-3330.
3. E-mail: FrankS@HagneyArchitects.com.

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

1. Mechanical, Electrical, Plumbing and Fire Protection: CS 2 DESIGNGROUP, LLC:
 - a. Engineer's Representative: Robert Siil.
 - b. Tel. 847-981-1880.
 - c. E-mail: rsiil@cs2designgroup.com.
2. Structural: One Design and Engineering, LLC:
 - a. Engineer: Patrick Eagan.
 - b. Tel. 608-577-0443.
 - c. E-mail: patrick@onedne.com.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
 - 1. This project involves the buildout of the shell space at the east end of the Field House at Auburn High School for two locker rooms, athletic offices, storage, and training rooms. The work includes all architectural, MEP, and FP work as indicated on the documents, in order to complete the project.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.4 PHASED CONSTRUCTION

- A. The Work shall be conducted as a single phase, but the completion date for the Training Room is earlier than the rest of the work.
 - 1. Commencement of Construction: June 19, 2024.
 - 2. Substantial Completion of Training Room: August 16, 2024.
 - 3. Substantial Completion of all work except the Training Room: To Be Determined.
 - 4. Final Completion of Training Room: August 23, 2024.
 - 5. Final Completion of all work except the Training Room: To Be Determined.

1.5 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.
- B. Concurrent Work: The Owner has and will award separate contracts for the following construction operations at the Project site. Those operations will be conducted simultaneously with work under this Contract.
 - 1. Auburn High School Roof Replacement for replacement of the roofing membrane and coping. Work to start June 19, 2024 and continue through the fall of 2024.

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 - 1. Provide for delivery of Owner-furnished products to Project site.
 - 2. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 - 3. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
 - 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.

2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Toilet accessories; toilet paper dispensers, napkin dispensers, napkin disposal bins, and soap dispensers. Refer to drawings.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits on Use of Site: Confine construction operations to work area and nearby areas as required for access. On-site staging and parking area will be designated by Owner's representative.
 2. Driveways, Walkways, and Entrances: Keep driveways and loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy the site and areas of the existing building adjacent to the construction area during "non-Summer" portion of construction period (before June 11, 2024 and after August 16, 2024). Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
- B. Partial Owner Occupancy during the Summer (June 11, 2024 – August 16, 2024): Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1.9 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
- D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify **Owner** not less than **two** days in advance of proposed disruptive operations.
- E. Smoking and Controlled Substance Restrictions: **Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.**
- F. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. See Owners Information and requirements.
 - 2. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 011100 – MISCELLANEOUS PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indemnification.
2. Execution, Correlation, and Intent.
3. Miscellaneous Provisions.

B. Related Requirements:

1. AIA Document A201 - 2017 "General Conditions of the Contract for Construction".
2. See Owner's Information.

1.2 INDEMNIFICATION

- A. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless Architect, Owner, and its affiliated companies, their partners, joint ventures, representatives, members, designees, officers, directors, shareholders, employees, successors, and assigns from and against all claims, damages, losses and expenses, including but not limited to reasonable attorney's fees, arising out of or resulting from Contractor's performance of its Work under the Agreement, and indemnifies and agrees to defend and hold harmless Architect and Owner against any all losses, claims, damages and expenses arising from the Work performed hereunder of the erection, construction, placement or operation of any scaffold, hoist, crane, stay, ladder, support or other mechanical contrivance in connection with such Work.
- B. Contractor agrees that it is solely responsible for compliance with all safety laws applicable to the Work performed hereunder, including but not limited to the Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1960 and all standards and regulations which have been or shall be promulgated by the agencies which administer the Acts.
- C. Under no circumstances shall contractor, its subcontractors, agents, and employees, be required to indemnify Owner for the Owner's own negligence.

1.3 EXECUTION, CORRELATION, AND INTENT

- A. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:
1. The Agreement.
 2. Addenda; with those of later date having precedence over those of earlier date.
 3. The Supplementary Conditions.
 4. General Conditions of the Contract for Construction.
 5. Drawings and Specifications.

- B. In case of inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
- C. In case of inconsistency between the Contract Documents and applicable standards, codes and ordinances, the Contractor shall provide the better quality or greater quantity of the Work or comply with the more stringent requirement.
- D. Before ordering any materials or doing any Work, the Contractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. Any difference which may be found shall be submitted to the Architect for interpretation before proceeding with the Work as a condition precedent to any claim for an increase in the Contract Sum or GMP.
- E. In the event that Work is called for by the drawings but not the specifications, or by the specifications but not by the drawings, the Contractor shall be responsible for such Work.
- F. When noticeable discrepancies among or between the Contract Documents and apparent or observable conditions exist, the Contractor shall request an interpretation in writing from the Architect before proceeding with the Work. If the Contractor fails to request such an interpretation from the Architect, it is presumed that the more stringent, better quality requirement is included in the Work. The Contractor shall be responsible for the cost and installation of such requirement at no additional cost to Owner. The Contractor shall not be entitled to a change order in connection with implementing such requirements.
- G. In all cases of interconnection of its Work with existing or other work, the Contractor shall verify at the site dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify all such grades, elevations, locations, dimensions, field measurements or field conditions, shall be promptly rectified by the Contractor at no cost to the Owner.

1.4 ELECTRONIC MEDIA

- A. In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by Hagney Architects, LLC, the recipient agrees that all such drawings and data are instruments of service of Hagney Architects, LLC, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory and other rights, including copyrights. Any inconsistencies the recipient discovers will be reported to Hagney Architects, LLC, and will be corrected by Hagney Architects, LLC.
- B. In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by Hagney Architects, LLC, the recipient agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of these documents. The recipient agrees to waive all claims against Hagney Architects, LLC, resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than Hagney Architects, LLC. In addition, the recipient agrees, to the fullest extent permitted by law, to indemnify and hold Hagney Architects, LLC, harmless from any damage, liability or costs, including reasonable attorney fees and costs of defense,

arising from any changes made by anyone other than Hagney Architects, LLC, or from any reuse of the drawings and data without the prior written consent of Hagney Architects, LLC.

- C. Because of the possibility that the Electronic Instruments of Services, and other information and data delivered in machine readable form may be subject to alteration, deterioration, incompatibility, translation or readability issues, whether inadvertently or otherwise, Contractor acknowledges and agrees that Architect shall have no responsibility or liability out of or in connection with the completeness or accuracy of the Electronic Instruments of Service, information and data, and any use by the Contractor of same is at Contractor's sole risk and responsibility. The use of Hagney Architects, LLC, drawings, and information does not alleviate the responsibility of the recipient to field verify all dimensions and information, as related to the scope of work.

1.5 MISCELLANEOUS

- A. The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. If for any reason the Work in place does not comply with the Contract Documents, the Contractor shall correct the Work before proceeding.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

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

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

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied,

Architect will return requests without action, except to record noncompliance with these requirements:

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

B. Architects' approval is based upon design intent only. General Contractor/manufacturer assumes responsibility for variations in performance and installation.

C. Substitutions for Convenience: Not allowed.

D. Substitutions for Convenience: Architect **may** consider requests for substitution if received within **[60]** sixty days after **the Notice of Award**. Requests received after that time may be considered or rejected at discretion of Architect.

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

uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500



SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E 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 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

1.3 PROPOSAL REQUESTS

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

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Architect may issue a Work Change Directive. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. See Owners Information regarding payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 - 4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 - 6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by **the tenth of the month**. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit **pencil copy of Application for Payment at least 23 days prior to School Board Meeting date** for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 - 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 - 6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow **five** working days for Architect's response for each RFI. RFIs received by Architect or Program Manager after 1:00 p.m. will be considered as received the following working day.
 - 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of re-

ceipt of the RFI response.

- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B.
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect and Program Manager.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's and Program Manager's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response. [Response regarding disagreement to include the following:](#)
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: General Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Program Manager, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Program Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for RFIs.
 - f. Procedures for testing and inspecting.

- g. Procedures for processing Applications for Payment.
 - h. Distribution of the Contract Documents.
 - i. Submittal procedures.
 - j. Preparation of record documents.
 - k. Use of the premises and existing building.
 - l. Work restrictions.
 - m. Working hours.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Procedures for moisture and mold control.
 - q. Procedures for disruptions and shutdowns.
 - r. Construction waste management and recycling.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. Progress cleaning.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Program Manager, and Owner's Commissioning Authority of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written instructions.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Installation procedures.
 - u. Coordination with other work.
 - v. Required performance results.

- w. Protection of adjacent work.
 - x. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: General Contractor will conduct progress meetings at weekly intervals.
- 1. Attendees: Weekly progress review meetings with Owner, Architect and Contractor are required. These meetings are to be limited to Owner, Architect and General Contractor only. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 - 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or rec-

ognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Site condition reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
 - 2. Two paper copies.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.

- E. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's and Program Manager's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.

- e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- B. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- C. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.

3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 DEFINITIONS

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

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Submit submittals schedule [within \[30\] thirty days of Notice of Award](#). Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.

12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810 transmittal form.

E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals for Utilizing Web-Based Project Management Software: Prepare submittals as PDF files, or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
3. Paper: Prepare submittals in paper form, and deliver to Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
 - a. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the

Contract Documents. Include evidence of manufacturing experience where required.

4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

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

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp or indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 - 1. REVIEWED without Comment.
 - 2. REVIEWED as Noted.
 - 3. REJECTED.
 - 4. REVISE and Resubmit.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Architect will return without review submittals received from sources other than Contractor.
- E. Submittals not required by the Contract Documents will be returned by Architect without action.
- F. Architect's review is for design intent and general compliance with Contract Documents ONLY. No responsibility is assumed for correctness of dimensions, quantities, details or deviations from the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 USE CHARGES

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

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and the 2018 Illinois Accessibility Code.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

3.3 TEMPORARY UTILITY INSTALLATION

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

- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - 3. Maintain and touch up signs so they are legible at all times.
- F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided 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.
 1. Do not load elevators beyond their rated weight capacity.
 2. 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.
- I. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Tree and Plant Protection: 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.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 3. Provide walk-off mats at each entrance through temporary partition.
- J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
- 3.6 MOISTURE AND MOLD CONTROL
- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

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

facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for requests for substitutions.

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.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
 - c. Contractor will assume full responsibility for final verification that product substitution – at minimum – meets original product.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 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.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. Refer to Divisions 02 through 33. Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

- with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- 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 Division 01 Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Coordination of Owner-installed products.
 - 7. Progress cleaning.
 - 8. Starting and adjusting.
 - 9. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for coordination of Owner-furnished products, Owner's separate contracts, and limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.2 DEFINITIONS

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

1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as

- intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

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

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. 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: Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

3.4 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance or as indicated on documents.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.

- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Remove waste materials daily.
- 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. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

3.8 PROTECTION AND REPAIR 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. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

END OF SECTION 017300

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. See Divisions 2 through 12 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.2 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least **10** days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: 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.

1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. 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.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. 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's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.4 WARRANTY

- 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 3. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 4. Stone Sill: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Recycling nonhazardous construction waste.
 - 2. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- 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.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

3.2 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, 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.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Complete startup and testing of systems and equipment.
 2. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 4. Complete final cleaning requirements, including touchup painting.
 5. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection to determine 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.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include school name and identification of each incomplete item and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.6 SUBMITTAL OF PROJECT WARRANTIES

- A. 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, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- B. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
- b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
- c. Remove tools, construction equipment, machinery, and surplus material from Project site.
- d. Clean exposed exterior 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.
- e. Remove labels that are not permanent.
- f. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

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

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit **by uploading to web-based project software site**. Enable reviewer comments on draft submittals.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least **15** days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within **15** days of receipt of Architect's comments and prior to commencing demonstration and training.
- D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

Retain "Manuals, Paper Copy" Paragraph below for projects requiring paper copy manuals.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, **[loose-leaf] [post-type]** binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
2. 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.

Avoid placing loose, oversize drawings in binder pockets. Use reduced drawings or place folded drawings in labeled envelopes bound in manual.

- 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.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: 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 to contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. 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.
- D. 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.
- E. 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.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

- B. 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 warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; 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.
 - a. 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.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- 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. 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.
- H. 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.

1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. 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.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit 2 set(s) of marked-up record prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned Record Prints and 2 sets of file prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit two paper copies of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories and two paper copies of each submittal.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.

- e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - 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.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 1. Format: Annotated PDF electronic file.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Note related Change Orders and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
- C. Format: Submit Record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data, and 1 paper copy.

1.6 MAINTENANCE OF RECORD DOCUMENTS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. At completion of training, submit complete training manual(s) for Owner's use prepared in same **paper and PDF file** format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 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 Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. 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.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 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.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, with at least **seven** days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral**, **a written**, or **a demonstration** performance-based test.
- F. Cleanup: Collect used and leftover educational materials and **remove from Project site**. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

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

1.3 PREINSTALLATION MEETINGS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of selective demolition activities with starting and ending dates for each activity.
- C. Predemolition photographs or video.

1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Inventory and record the condition of items to be removed and salvaged.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video. Comply with Section 013233 "Photographic Documentation."
1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
 2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.
- D.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
 - h. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 4. Maintain fire watch during and for at least 30 minutes after flame-cutting operations.
 - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 6. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 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 designated by Owner.
 - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 024126 - SELECTIVE ELECTRICAL DEMOLITION**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.

B. Disposal of materials.

1. Storage of removed materials.
2. Identification of utilities.
3. Salvaged items.
4. Protection of items to remain as indicated on Drawings.
5. Relocate existing equipment to accommodate construction.

1.2 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.3 SCHEDULING

- A. Schedule work to coincide with renovation schedule.
- B. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.4 COORDINATION

- A. Conduct demolition to minimize interference with adjacent building areas.
- B. Coordinate demolition work with general contractor and other trades.
- C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.
- D. Shut-down Periods:
 1. Arrange timing of shut-down periods of in service panels with Owner. Do not shut down any utility without prior written approval.
 2. Keep shut-down period to minimum or use intermittent period as directed by Owner.
 3. Maintain life-safety systems in full operation in occupied facilities or provide notice minimum one week in advance.
 4. Identify salvage items in cooperation with Owner.

1.5 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.

- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- C. Verify termination points for demolished services.
- D. Verify field measurements and circuiting arrangements as shown on Drawings.
- E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- F. Contractor shall provide all investigative work required to trace out and identify source of existing loads including those which are to remain after demolition.
- G. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.
- B. Temporary egress signage and emergency lighting.
- C. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal or as required.
- D. Coordinate utility service outages with school district shut-down schedule, Construction Manager and Utility Company.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. Provide a permanent solution to maintain systems upon completion of construction.
- F. Contractor shall remove existing electrical devices, fixtures, equipment, etc. as required to accommodate the renovation. It shall be this contractor's responsibility to maintain power to existing downstream items which remain active after the demolition. Provide all necessary conduit, wiring, cutting and patching, etc.
- G. Perform all demolition of ceiling, wall and floor surfaces per the requirements of Specification Division 02 - Selective Demolition.
- H. Existing Electrical Service: Maintain existing system in service. Disable system only to make switchovers and connections. Obtain permission from Owner and construction manager at least one week before partially or completely disabling system. System shutdown shall occur only during an Owner approved shutdown period. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- I. Existing Fire Alarm System: Maintain existing system in service. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. All Fire Alarm devices, cabling, conduit and boxes to be removed as required to accommodate the renovation and addition projects.
- J. Existing Information (Data/Voice) System: All information systems, devices, cabling, conduit and boxes to be removed as required to accommodate the renovation and addition projects.
- K. Existing Sound/Paging System: All sound/paging system devices, cabling, conduit and boxes to be removed as required to accommodate the renovation and addition projects.

3.3 DEMOLITION

- A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation.
- B. Remove exposed abandoned conduit including abandoned conduit above accessible ceiling finishes. Cut embedded conduit flush with walls, floors, and patch surfaces.

- C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- E. Reconnect equipment being disturbed by renovation work and required for continue service to previous source if remaining or nearest available panel.
- F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.
- G. Install temporary wiring and connections to maintain existing systems in service during construction.
- H. Perform work on energized equipment or circuits with experienced and trained personnel.
- I. Remove, relocate, and extend existing installations to accommodate new construction.
- J. Repair adjacent construction and finishes damaged during demolition and extension work.
- K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finish. Cut embedded support elements flush with walls and floors.
- L. Clean and repair existing equipment to remain or to be reinstalled.
- M. Protect and retain power to existing active equipment remaining.

3.4 EXISTING PANELBOARDS

- A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.
- B. Tag unused circuits as spare.
- C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.
- D. Remove existing wire no longer in use from panel to equipment.
- E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS

- A. Remove and protect items indicated on Drawings to be salvaged and turn over to Owner.
- B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed to location as directed by Owner.

3.6 REUSABLE ELECTRICAL EQUIPMENT

- A. Carefully remove equipment, materials, or fixtures which are to be reused.
- B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.
- C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.7 CLEANING

- A. Remove demolished materials as work progresses. Legally dispose.
- B. Keep workplace neat.
- C. Clean and repair existing materials and equipment which are to be reused.
- D. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.8 PROTECTION OF FINISHED WORK

- A. Do not permit traffic over unprotected floor surface.
- B. Coordinate floor protection with General Contractor or Construction Manager.

END OF SECTION 024126

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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

2.2 FORM-FACING MATERIALS

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

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I.
 - 2. Fly Ash: ASTM C 618, Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
 - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
- D. WVRA: ASTM C 494/C 494M, Type S; complex catalyzed hydrous silicate, water and vapor proofing liquid admixture.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Specialty Products Group Vapor Lock 20/20®.
 - 2. Properties: W/C Ratio: Maximum .052 without written permission and approval of mix design by WVRA manufacturer.
- E. Water: ASTM C 94/C 94M and potable.

2.5 FIBER REINFORCEMENT

- A. Synthetic Monofilament Microfiber: Monofilament polypropylene microfibers complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. FullForce by ABC Polymer Industries, LLC
 - b. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
 - c. Mapei Corporation
- B. Synthetic Fibrillated Microfiber: Fibrillated polypropylene microfibers complying with ASTM C1116/C1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
- C. Synthetic Macrofiber: Synthetic macrofibers complying with ASTM C1116/C1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. FullForce by ABC Polymer Industries, LLC
 - b. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.
 - c. Mapei Corporation

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
- B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 15 mils (0.38 mm) thick.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, and concrete with a w/c ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: As indicated at 28 days.
 - 2. Maximum W/C Ratio: Per ACI 318 and ACI 301.
 - 3. Slump Limit: 5 inches (125 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, 8 inches, plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Chamfer exterior corners and edges of permanently exposed concrete, as indicated on Drawings.

3.2 EMBEDDED ITEM INSTALLATION

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

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 2. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.7 FINISHING FORMED SURFACES

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

- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated to receive trowel finish [and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, measured within 24 hours, according to ASTM E 1155/E 1155M, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application. SEE DETAIL.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written

instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 4. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 - 5. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

- E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and numbers, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Glazed Structural Clay Facing Tile.
 - 3. Mortar and grout.
 - 4. Steel reinforcing bars.
 - 5. Masonry joint reinforcement.
 - 6. Ties and anchors.
 - 7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Glazed Structural Clay Facing Tile: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. Samples for Verification: For each type and color of the following:
 - 1. Glazed Structural Clay Facing Tile.
 - 2. Pigmented and mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness.
2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide bullnose units for outside corners and as indicated on top of gym wall unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.

2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

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

2.4 STRUCTURAL CLAY FACING TILE

- A. General:
 1. Where reinforced masonry is indicated, provide multicored units designed for use in reinforced, grouted masonry, either with vertical cores and with webs notched to receive horizontal reinforcement, or with horizontal cores and with holes in bed shells for placement of grout and to receive vertical reinforcement.
 2. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated, including applications that cannot be produced by sawing standard units.
- B. Glazed Structural Clay Facing Tile: ASTM C126, Grade S (Select).
 1. Basis-of-Design Product: **Elgin Butler Structural Glazed tile, or equal.**
 2. Sizes: 8W Series with actual face dimensions of 7-5/8 inches high by 15-5/8 inches long by widths indicated.
 3. Width: Manufactured to dimensions 5/16 inch or 3/8 inch less than nominal dimensions.
 4. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 5. Provide special units glazed on ends and tops, as well as faces for corners, jambs, sills, pilasters, columns, and other applications indicated, where glazed units are exposed on other surfaces and faces.
 6. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- E. Aggregate for Grout: ASTM C 404.
- F. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- H. Water: Potable.

2.6 REINFORCEMENT

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

2. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus **one side rod** at each wythe of masonry 4 inches wide or less.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.7 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 1. All ties, anchors, and fasteners shall extend into substrates where steel stud back up. All fasteners shall be anchored securely into studs.
 2. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 3. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 4. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
 5. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60zinc coating.
 6. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 7. Stainless-Steel Sheet: ASTM A 666, Type 304.
 8. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
 2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
 3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire or Mill-galvanized wire may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- or 0.25-inch-diameter, hot-dip galvanized steel or Mill-galvanized wire may be used at interior walls unless otherwise indicated.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

2.9 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

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

1. For masonry below grade or in contact with earth, use Type M.
 2. For reinforced masonry, use Type S.
 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
- E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units: Glazed Structural Clay Facing Tile.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

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

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

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

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

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
- B. Lay structural clay tile as follows:
 1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
 3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.
- C. Rake out mortar joints at **glazed structural clay tile** to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

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

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

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

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 MASONRY WASTE DISPOSAL

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

END OF SECTION 042000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Wood blocking, cants, and nailers.
 - 3. Wood furring and grounds.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Power-driven fasteners.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior

construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 12 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 1. Wood 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, stripping, and similar concealed members in contact with masonry or concrete.

2.3 DIMENSION LUMBER FRAMING

- A. Framing Other Than Non-Load-Bearing Partitions: No. 2 grade.
 1. Application: Framing other than interior partitions.
 2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Douglas fir-larch; WCLIB or WWP.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB or WWP.
 - e. Douglas fir-larch (north); NLGA.
 - f. Spruce-pine-fir (south); NeLMA, WCLIB, or WWP.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Framing
 2. Blocking.
 3. Nailers.
 4. Cants.
 5. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 2. Eastern softwoods; No. 2 Common grade; NeLMA.
 3. Northern species; No. 2 or better Common grade; NLGA.

4. Western woods; Standard or No. 2 Common grade; WCLIB or WWPA.

2.5 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate backing, furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- F. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).

3.2 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Sealant A:
 - a. Joints around door and window frames.
 - b. Joints of flashing and counterflashing.
 - c. Joints around louvers, vents, and other mechanical penetrations of exterior surfaces.
 - d. Joints between dissimilar exterior materials.
 - 2. Sealant C:
 - a. Expansion/contraction joints in concrete pavings and floor slabs.
 - 3. Sealant E:
 - a. Interior joints around door and window frames, joints between dissimilar interior materials.
- B. See Division 08 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- 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.
- D. Product test reports.
- E. Preconstruction compatibility and adhesion test reports.
- F. Preconstruction field-adhesion test reports.
- G. Field-adhesion test reports.

- H. Warranties.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Sealant A: One component urethane, non-sag, gun grade elastomeric sealant; color as selected by Architect; provide one of the following:
 - 1. Pecora: Dynatrol I
 - 2. Sonneborn: Sonalastic NP 1
 - 3. Tremco: Dymonic
- F. Sealant C: One component urethane, pour grade, self-leveling elastomeric sealant; color as selected by Architect; provide one of the following:
 - 1. Pecora: Urexpan NR201
 - 2. Sika: Sikaflex 12SL
 - 3. Sonneborn: Sonalastic SL1
- G. Sealant D: Semi-rigid epoxy; self-leveling; chemical resistant; provide one of the following:
 - 1. General Polymers: 3550J Joint Guard
- H. Sealant E: Acrylic latex sealant; paintable; color as selected by Architect.
- I. Joint Filler: Backer rod for elastomeric sealants. Extruded closed-cell polyethylene foam or polyethylene jacketed polyurethane foam, non-bleeding, non-staining, oversized 30 to 50 percent; provide one of the following:
 - 1. Dow: Ethafoam
 - 2. Meadows: Backer Rod
 - 3. Sonneborn: Sonofoam Backer Rod

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg. F (minus 32 deg. C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- 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 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 2. Remove laitance and form-release agents from concrete.
 - a. 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.
- 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.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C919 for use of joint sealants in acoustical applications 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.
- G. 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.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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 00 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 Section "Painting" for field painting hollow metal doors and frames.

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.

1.3 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. 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).
 - 3. Steelcraft (S).

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 (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22-gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
 - 3. 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.
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. 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.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. 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. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. 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.
 6. 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.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Interior Doors (Energy Efficient): Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. 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. Core Construction: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22-gauge steel-stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, No stiffener face welding is permitted.
 - b. Acoustical sound transmission rating shall be no less than STC 38 complying with ASTM E 90 and must be visible on factory applied labels.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges—to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. 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.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. 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. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
4. 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.
5. 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.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

F. Manufacturers Basis of Design:

1. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.

C. 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 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

- a. CECO Door Products (C) – SU SR Series.
- b. Curries Company (CU) – M Series.
- c. Curries Company (CU) – Kerfed Weatherstripped WM Series.

D. 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) - C Series.
- b. Curries Company (CU) - M Series.
- c. Curries Company (CU) – Kerfed Weatherstripped WM Series.

- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. 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 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.

2.7 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.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for 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.
- 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.

2.9 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.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

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. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. 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.

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.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS

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

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Ampco, Inc.
3. Graham; an Assa Abloy Group company.
4. Haley Brothers, Inc.
5. Mohawk Flush Doors, Inc.; a Masonite company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
3. Provide doors with glued-wood-stave cores instead of particleboard cores for doors indicated to receive exit devices.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: To match existing.
3. Cut: To match existing.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Core: Particleboard.
7. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
8. Construction: Seven plies, either bonded or nonbonded construction.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Premium.

2. Finish: AWI conversion varnish system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

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. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Door Hardware Schedule".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. 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:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols,

hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced 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 to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with

required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 3. Five years for exit hardware.
 - 4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets. Use non-removable pins at exterior doors and the doors at the Fieldhouse.
 - 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: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. Hager Companies (HA) - CB Series.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
 - c. Stanley Hardware (ST) - CB Series.
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Manufacturers:

- a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
- C. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:
 - a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE)
- SER-QC (12 wires) Option.
- B. Electrified Quick Connect Stainless Steel Continuous Transfer Hinges: Provide electrified transfer stainless steel continuous hinges with electrical transfer access prep accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR)
- MP-ETAP-EL (12 wires) Option.
- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

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

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Manufacturer's Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
 - 1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 2, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
 - 1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security cylinders.
 - a. Level 2 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
 - 2. Manufacturers:
 - a. Sargent Manufacturing (SA) - **LK Series.**
 - b. Corbin Russwin (RU) – **Equal to Sargent product above**
 - c. Schlage (SC) – **Equal to Sargent product above**
- F. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. New System: Key locks to a new key system as directed by the Owner.
- G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys: Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

H. Construction Keying: Provide temporary keyed construction cores.

I. 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.

J. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 2 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 certified.

1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
2. Locks are to be non-handed and fully field reversible.
3. Manufacturers:
 - a. Schlage (SC) – **ND Series. Match existing latch set style and finish. Verify RHO latch set & 626 finish.**

B. Knurling: Where required by local code provide knurling or abrasive coating to all levers on doors leading to hazardous areas such as mechanical rooms, boiler and furnace rooms, janitor closets, and as otherwise required or specified.

2.7 INTEGRATED WIEGAND OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wiegand Output Multi-Class Cylindrical Locks: Wiegand output ANSI A156.2, Grade 1, Cylindrical Lockset with integrated card reader and request-to-exit signaling in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim with 1/2" deadlocking stainless steel latch. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside lever handle (request-to-exit) signaling standard with door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:
 - a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.

- b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.
3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
6. Manufacturers:
 - a. Corbin Russwin (RU) – CL3300 SE-LP10 Series.
 - b. Sargent Manufacturing (SA) – M1 10 Line.

2.1 WIRELESS ACCESS CONTROL LOCKS

- A. Wireless Access Control Cylindrical Locks: Wireless technology ANSI/BHMA A156.2 Series 4000 Grade 1 cylindrical lockset with integrated card reader and request-to-exit signaling in one complete unit. Separate DPS connects directly to lock electronics for door position (open/closed status) monitoring. Motor driven locking/unlocking control of the lever handle trim with 1/2" deadlocking stainless steel latch. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings.
 1. Wireless access control cylindrical locks interface using local wireless connection between the lock unit and a nearby communication hub. Communication hub connected via RS-485 or Wiegand to a new or existing online electronic access control system platform.
 2. Fully-encrypted AES 128 wireless communication between lock and communication hub (IEEE 802.15.4, 2.4 GHz) with no proprietary programming device requirements. Locks will continue functional operation independent of wireless connection slowdown or failure.
 3. Integrated reader supports HID® 125kHz proximity credentials; or ISO 14443 A/B and ISO 15693 13.56 MHz contactless credentials: HID® iCLASS/iCLASS SE (full authentication, all formats), MIFARE Classic, DESFire EV1 (full authentication, all formats); or Near Field Communications (NFC); or HID® SIO enabled.
 4. Power Source: 6 AA alkaline batteries power supply with LED indication of locked, programming mode and low capacity warning status conditions.
 5. Outside lever rigid except when valid user code is entered. Emergency override access capability with optional mechanical key cylinder retraction of lock latch bolt without necessary electronic activation.
 6. Communication Hub: Provide the necessary number of hubs which is connected to the access control system via RS-485 or Wiegand as required by the system. Provide hubs factory paired with the locks, but allow for field configuration as needed.
 7. Complete installation to include manufacturer's Installation Tool and USB Radio Dongle for initial lock set-up and configuration. Electronic on-line access control system platform, including communication cabling and software, by others.

8. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – IN100 – CL33800 Series.
 - b. Sargent Manufacturing (SA) – IN100 10 Line Series.

2.2 AUXILIARY LOCKS

- A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13, Series 1000, Grade 1, certified large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Yale Locks and Hardware (YA) - 8800 Series.

2.3 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.

2.4 ELECTROMAGNETIC LOCKING DEVICES

- A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of accepting between 12 to 24 volts direct current and be UL listed for use on fire rated door assemblies. Electromagnetic coils are to consume no more than 1.5W during normal operation. Locks are to have an integrated door position switch, tamper switch, and lock bond sensor. Locks are to have integrated motion sensor and/or security camera as indicated in the hardware sets. Locks to be capable of detecting door prop conditions and entering low power mode. Provide mounting accessories as needed to suit opening conditions. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:
 - a. HES Innovations – [Similar to the 9600 series](#).
 - b. Securitron (SU) – M680E Series.

2.5 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 6. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 7. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
 8. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

11. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) [ED5000 Series](#).
 - b. Sargent Manufacturing (SA) - [8800 Series](#).
 - c. Von Duprin (VD) – [98/99 RIM XP Series](#).

2.6 INTEGRATED WIEGAND OUTPUT EXIT DEVICES – MULTI-CLASS READER

- A. Integrated Wiegand Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.
1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
 2. Integrated reader supports the following credentials:
 - a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
 - b. 13.56 MHz proximity credentials: HID iClass, HID iClass SE, SE for MIFARE Classic, DESFire EV1.
 3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
 4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
 5. Competitor Alternates Allowed Option>Installation to include manufacturer's access control panel interface board or module where required for Wiegand output protocol.
 6. Manufacturers:
 - a. Corbin Russwin (RU) – [ED5000 SE-LP10 Series](#).
 - b. Sargent Manufacturing (SA) – [M1 80 Series](#).

2.7 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer 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 (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. Norton Door Controls (NO) – 9500 Series.
 - c. Sargent Manufacturing (SA) - 281 Series.
- C. Door Closers, Surface Mounted (Unitrol): Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - Unitrol Series.
 - b. Norton Door Controls (NO) - Unitrol Series.
- D. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Door Controls (NO) - 8500 Series.
 - c. Sargent Manufacturing (SA) - 1431 Series.

2.8 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.9 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

c. Trimco (TC).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson Door Controls (RF).
- b. Sargent Manufacturing (SA).

2.10 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. National Guard Products (NG).
2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
3. Reese Enterprises, Inc. (RE).

2.11 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O

switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

- a. Security Door Controls (SD) - DPS Series.
- b. Securitron (SU) - DPS Series.
- c. HES Innovations.

- B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:

- a. Security Door Controls (SD) - 630 Series.
- b. Securitron (SU) - BPS Series.
- c. HES Innovations.

2.12 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.

2.13 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. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.
- C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- D. 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.
- 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: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. **See drawings for hardware sets.** Hardware schedule is furnished for whatever guidance and assistance it may afford the Contractor but shall not necessarily be considered as entirely inclusive. The Contractor shall examine the Drawings and the Specifications to determine the extent, quality, and function of hardware required and shall be responsible to furnish all necessary architectural finish hardware to complete the work. Should any door or item be inadvertently omitted from the scheduled hardware, such door or item shall be provided with the same hardware as required for similar purposes. Should it be determined that the hardware scheduled is not suitable due to detail or size of member, the hardware of proper size, type and function shall be provided, similar in operation and equivalent to that specified. Whether listed or not, provide latching lock set, door closer, and smoke gasketing at all labeled doors.
 - 1. All hardware to be reviewed with Owner prior to ordering. Must meet all applicable codes.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
 - 2. Interior borrowed lites.
 - 3. All glass will be tempered laminated glass.

1.2 DEFINITIONS

- A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
- D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: 5/16", unless otherwise noted.

- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- (12.7-mm-) wide interspace.
 - 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: 12-inch- (300-mm-) square, for each type of glass product indicated, other than monolithic clear float glass.

1.5 QUALITY ASSURANCE

- A. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 NFPA 257.
- B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
- C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

1.6 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units

that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Product: Subject to compliance with requirements, provide product specified.
 4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS PRODUCTS

- A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 3. Sealing System: Dual seal.
 4. Spacer Specifications: Manufacturer's standard spacer material and construction.
 5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with black, color anodic finish.
 - b. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 1. Neoprene, ASTM C 864.
 2. EPDM, ASTM C 864.
 3. Silicone, ASTM C 1115.
 4. Thermoplastic polyolefin rubber, ASTM C 1115.

5. Any material indicated above.

2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

2.5 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.6 INSULATING-GLASS UNITS

- A. Passive Solar Low-E Insulating-Glass Units IG:
 1. Outdoor Lite: Class 1 (clear) float glass.
 - a. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.
 2. Indoor Lite: Class 1 (clear) float glass.
 - a. Annealed.
 3. Low-E Coating: Pyrolytic on second surface.

PART 3 - EXECUTION

3.1 GLAZING

- A. General: 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.
 1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
 2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
 3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

4. 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.
 5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
 6. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 7. 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.
- B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
 2. 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.
 3. Apply heel bead of elastomeric sealant.
 4. 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.
 5. Apply cap bead of elastomeric sealant over exposed edge of tape.
- C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
1. 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.
 2. 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.
 3. Install gaskets so they protrude past face of glazing stops.
- D. Sealant Glazing (Wet): 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.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
 2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.2 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such

protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, 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.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
 - 1. Depth: 1-1/2 inches (38 mm).

- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
 - b. Depth: 3-5/8 inches (92.1 mm).
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 - 4. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm), unless noted otherwise on Drawings.
- B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 - 2. Depth: 7/8 inch (22.2 mm).
- D. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.

PART 3 - EXECUTION

3.1 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.

3.2 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. 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. Do not attach hangers to wood roof deck.
 - 4. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. 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.
- D. 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.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-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. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
1. Screw to wood framing.
- D. Z-Furring Members:
1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

PART 1 GENERAL

1.1 SUMMARY

- A. Provide finish for exterior gypsum or cement board soffit and ceiling surfaces.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Safety Data Sheets.

1.3 REFERENCES

- A. ASTM Standards
 - 1. C920, Specification for Elastomeric Joint Sealants
 - 2. C1177, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - 3. C1325, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
 - 4. E84, Standard Test Method for Surface Burning Characteristics of Building Materials
- B. South Coast Air Quality Management District (South Coast AQMD)
 - 1. Rule 1113, Architectural Coatings

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: The finish manufacturer shall be a company with at least thirty five years of experience in manufacturing acrylic plaster and specialty finishes and regularly engaged in the manufacture and marketing of products specified herein. The manufacturer shall have an ISO 9001:2008 certified quality system and ISO 14001:2004 certified environmental management system.
- B. Installer's Qualifications: The contractor shall be qualified to perform the work specified by reason of experience. Contractor shall have at least 5 years of experience in acrylic plaster or specialty finish application, and shall have completed at least 3 projects of similar size and complexity. Contractor shall provide proof before commencement of work that he/she will maintain and supervise a qualified crew of applicators through the duration of the work. When requested Contractor shall provide a list of the last three comparable jobs including the name, location, and start and finish dates for the work.
- C. Mock-ups: The contractor shall install a mock-up of the finished wall surface for evaluation and approval by the design professional, building owner, or owner's representative/quality assurance agent.
- D. Testing: Testing shall be conducted as directed by the design professional, building owner, or owner's representative/quality assurance agent to verify soffit/ceiling assembly performance and adhesion to prepared substrates.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original packaging, labeled with product identification, manufacturer, and batch number.

- B. Store products in a dry area with temperature maintained between 50 and 85 degrees F (10 and 29 degrees C). Protect from direct sunlight. Protect from freezing. Protect from extreme heat (>90 degrees F [32 degrees C]).
- C. Handle products in accordance with manufacturer's printed instructions.

1.6 WARRANTY

- A. Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Finishes, primers, adhesives, stains and any other associated materials used with the finish shall be Class A building materials based on testing in accordance with ASTM E84. VOC (Volatile Organic Content) shall be less than 50g/L and shall comply with South Coast AQMD Rule 1113 requirements.
- B. Gypsum or Cement Soffit or Ceiling Board
 - 1. PermaBase® Brand cement board as manufactured by National Gypsum in compliance with ASTM C1325
- C. Surface Reinforcement
 - 1. Sto Mesh – nominal 4.5 oz/yd² (153 g/m²) glass fiber reinforcing mesh treated for compatibility with Sto materials
- D. Base Coat – polymer modified portland cement base coat
 - 1. Sto BTS Xtra – factory blended dry powder extra high build base coat mixed with potable water
- E. Primer
 - 1. StoPrime® Sand – acrylic-based sanded primer for use with Sto Textured Finishes, Sto Specialty Finishes, Sto Signature Finishes, and StoCast Finishes
- F. Textured Finishes
 - 1. Stolit® HDP™ -- factory blended, decorative and protective, hydrophobic, acrylic textured wall finish with integral color
- G. Accessories
 - 1. StoSeal STPE Sealant - high-movement, low modulus, non-sag one-component silyl-terminated polyether joint sealant in compliance with ASTM C920
 - 2. Sto-Mesh Corner Bead Standard – one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh for outside corner reinforcement
 - 3. Sto Drip Edge Profile - one component PVC (polyvinyl chloride) accessory with integral reinforcing mesh that creates a drip edge and plaster return
 - 4. PVC Accessories for DEFS (Direct-Applied Exterior Finish Systems) – Polyvinyl Chloride (PVC) components for exterior use in compliance with ASTM D1784

2.2 PERFORMANCE REQUIREMENTS

1. Primers and applicable finish components: ASTM E84, flame Spread less than 25, smoke developed less than 75, Class A building material
2. Primers and applicable finish components: South Coast AQMD Rule 1113, Volatile Organic Content (VOC), comply with applicable requirement of coating category

PART 3 EXECUTION

3.1 INSTALLATION

- A. Gypsum or cement soffit board must be installed in conformance with the applicable building code and manufacturer's written installation instructions. Gypsum or cement soffit board surface must be clean, dry, and free of surface contamination. Soffit board surface shall not have planar irregularities in excess of 1/16 inch (1.6 mm) and shall be free of voids, cracks, and other surface defects.
- B. Mixing
 1. Mix Sto products in accordance with published literature. Refer to applicable Product Bulletins for specific information on use, handling, application, precautions, and limitations of specific products.
- C. Application
 1. Install corrosion proof termination accessories with perforated flanges for keying of the base coat at junctures with penetrations such as soffit vents, electrical fixtures, and with abutting walls and columns. Install corrosion proof control joints with perforated flanges for keying of the base coat at intervals as required by the soffit board manufacturer. Refer to Sto Guide details.
 2. Install nominal 1/8-inch (3 mm) base coat by trowel to the soffit/ceiling board surface. Work horizontally or vertically in strips of 40 inches (1016 mm), and immediately embed the Sto Mesh into the wet base coat by troweling from the center to the edge of the mesh. Overlap mesh installed at perforated accessory flanges by installing Sto Mesh up to the termination bead of the accessory. Overlap mesh not less than 2-½ inches (64 mm) at mesh seams and feather at seams. Double wrap all inside and outside corners with minimum 6-inch (152 mm) overlap in each direction (except where corner bead is used at outside corners lap mesh over perforated flange of accessory). Avoid wrinkles in the mesh. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Re-skim with additional base coat if mesh color is visible. Do not install base coat and mesh onto solid (unperforated) portions of accessories.
 3. When the base coat application is dry apply the primer by brush or roller to the entire base coat surface.
 4. When the primer application is dry apply the Sto finish
 - a. Sto Textured Finish Installation: Refer to applicable Product Bulletin
 - b. Sto Specialty Finish Installation: Refer to applicable Product Bulletin
 - c. Signature Finish Installation: Refer to applicable Sto Signature Finish Application Guide
 - d. StoCast Finish Installation: Refer to applicable StoCast Product Bulletin and Application Guide

D. Protection

1. Provide protection of installed materials from water infiltration into or behind them during and after construction.
2. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.
3. Seal penetrations through the finished surface with backer rod and sealant or other appropriate means

END OF SECTION

ATTENTION

Sto products are intended for use by qualified professional contractors, not consumers, as a component of a larger construction assembly as specified by a qualified design professional, general contractor or builder. They should be installed in accordance with those specifications and Sto's instructions. Sto Corp. disclaims all, and assumes no, liability for on-site inspections, for its products applied improperly, or by unqualified persons or entities, or as part of an improperly designed or constructed building, for the nonperformance of adjacent building components or assemblies, or for other construction activities beyond Sto's control. Improper use of Sto products or use as part of an improperly designed or constructed larger assembly or building may result in serious damage to Sto products, and to the structure of the building or its components. STO CORP. DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED EXCEPT FOR EXPLICIT LIMITED WRITTEN WARRANTIES ISSUED TO AND ACCEPTED BY BUILDING OWNERS IN ACCORDANCE WITH STO'S WARRANTY PROGRAMS WHICH ARE SUBJECT TO CHANGE FROM TIME TO TIME. For the fullest, most current information on proper application, clean-up, mixing and other specifications and warranties, cautions and disclaimers, please refer to the Sto Corp. website, www.stocorp.com.

SECTION 092613 - GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum veneer plaster.
 - 2. Panel products.
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-load-bearing steel framing.

1.2 ACTION SUBMITTALS

- A. Product data.
- B. Shop Drawings:
 - 1. Show locations, fabrication, and installation of control joints, reveals, and trim; include plans, elevations, sections, details of components, and attachments to other work.
- C. Samples: For each trim accessory and textured finish on rigid backing.

1.3 MOCKUPS

- A. Provide mockups of ceilings in sizes of at least 100 sq. ft. (9 sq. m).

PART 2 - PRODUCTS

2.1 GYPSUM VENEER PLASTER

- A. High-Strength, Two-Component Gypsum Veneer Plaster: ASTM C587, ready-mixed, base-coat plaster and smooth finish-coat veneer plaster containing mill-mixed, fine silica sand; with a compressive strength of 3000 psi (20 MPa) when tested according to ASTM C472.
 - 1. Base Coat, High Strength:
 - 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) USG Corporation.
 - 2. Smooth Finish Coat, High Strength:
 - 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) USG Corporation.

2.2 PANEL PRODUCTS

- A. Abuse-Resistant Gypsum Base for Veneer Plaster: With specially reinforced core for greater resistance to surface abrasion, indentation, soft-body impact, and hard-body impact.
 - 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. National Gypsum Company.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
 - 5. Moisture Resistant.
 - 6. Abuse Resistance: ASTM C1629/C1629M, Level 1.
- B. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With moisture- and mold-resistant core; fire-resistive rated; glass-mat facing on both sides of panel.
 - 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. Georgia-Pacific Gypsum LLC.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- C. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 and approved by backer unit manufacturer for use as veneer plaster substrate.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.3 TRIM ACCESSORIES

- A. Standard Trim: ASTM C1047, approved for use in gypsum veneer plaster applications indicated.
 - 1. Material: Galvanized-steel sheet or aluminum-coated steel sheet; rolled zinc, plastic, or paper-faced galvanized-steel sheet.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

2.4 JOINT-REINFORCING MATERIALS

- A. General: Comply with joint strength requirements in ASTM C587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.
- B. Joint Tape: As recommended by gypsum veneer plaster manufacturer for applications indicated.
- C. Embedding Material for Joint Tape: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.

2.5 AUXILIARY MATERIALS

- A. Bonding Agent: ASTM C631 polyvinyl acetate.
- B. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum-base, face-layer panels to backing-layer panels in multilayer construction.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- D. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- E. Sound Attenuation Blankets: ASTM C665, Type I; Comply with mineral-fiber requirements of assembly.
- F. Acoustical Joint Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION OF PANEL PRODUCTS

- A. Gypsum Base for Veneer Plaster: Apply according to ASTM C844 unless manufacturer's written recommendations are more stringent.
 - 1. Erection Tolerance: No more than 1/16-inch (1.6-mm) offsets between planes of gypsum base panels, and 1/8 inch in 8 feet (3 mm in 2.4 m) noncumulative, for level, plumb, warp, and bow.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Install sound attenuation blankets before installing gypsum base for veneer plaster.
- D. Cementitious Backer Units: Install according to ANSI A108.11.
 - 1. Where cementitious backer units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- E. Trim: Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- F. Control Joints: Install according to ASTM C844 and in specific locations approved by Architect.
- G. Gypsum Base: Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C843 and with gypsum veneer plaster manufacturer's written recommendations.

- H. Abuse-Resistant Base: Reinforce joints between abuse-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.
- I. Glass-Mat Interior Gypsum Board: Reinforce joints between moisture- and mold-resistant panels with joint tape and embedding material according to panel manufacturer's written recommendations.

3.2 APPLICATION OF GYPSUM VENEER PLASTER

- A. Bonding Agent: Apply bonding agent on dry abuse-resistant base panels according to gypsum veneer plaster manufacturer's written recommendations.
- B. Gypsum Veneer Plaster Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C843 and with gypsum veneer plaster manufacturer's written recommendations.
- C. Gypsum Veneer Plaster Application: Comply with ASTM C843 and with veneer plaster manufacturer's written recommendations.
 - 1. One-Component Gypsum Veneer Plaster: Trowel apply plaster over substrate to uniform thickness. Fill all voids and imperfections. Immediately double back with same mixer batch of plaster to a uniform total thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 - 2. Two-Component Gypsum Veneer Plaster:
 - a. Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm). Fill voids and imperfections.
 - b. Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform thickness of 1/16 to 3/32 inch (1.6 to 2.4 mm).
 - 3. Where gypsum veneer plaster abuts metal, including doorframes, windows and other units, groove finish coat to eliminate spalling.
 - 4. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations.
- D. Gypsum Veneer Plaster Finish: Smooth-troweled finish unless otherwise indicated.

END OF SECTION 092613

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Metal edge strips.

1.2 ACTION SUBMITTALS

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

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.

1.3 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 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.

1.4 QUALITY ASSURANCE

A. 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

- C. Low-Emitting Materials: Tile flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Tile Type CT: See Construction Drawings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Floor Tile: American Olean unglazed ceramic mosaic 2 x 2 x 1/4" tiles.
 - 2. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
 - 3. Grout Color: As selected by Architect from manufacturer's full range.
 - 4. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as indicated on drawings.

2.2 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- A. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.

2.3 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.
- B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Schluter Systems L.P.; KERDI.

2.4 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturer: Subject to compliance with requirements, provide products by the following:
 - a. Bostik, Inc.
 - 2. Prepackaged, dry-mortar mix to which only water must be added.
 - 3. For wall applications, provide nonsagging mortar.

2.5 GROUT MATERIALS

- A. Water-Based Urethane Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
 - 1. Manufacturer: Subject to compliance with requirements, provide the following:

- a. Bostik, Inc., TruColor™ pre-mixed, water-based, urethane grout.

2.6 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
 1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant or 100 percent Silicone Kitchen and Bath Sealant.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
 - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
 - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - f. Tremco Incorporated; Tremsil 600 White.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, stainless steel, ASTM A 666, 300 Series exposed-edge material.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American, an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer, Magic Seal, Silox 8 or Siloxane 220.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Surfaceguard, Grout and Tile or Grout Sealer.
 - e. Jamo Inc.; Penetrating Sealer.
 - f. MAPEI Corporation; KER.
 - g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

- i. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone or TA-257 Silicone Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify tile backer board is used at wall tile installations.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.
- E. Substrate Flatness:
 - 1. For tile shorter than 15 inches (381 mm), confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. (6.4 mm in 3 m) from the required plane, and no more than 1/16 inch in 12 inches (1.5 mm in 300 mm) when measured from tile surface high points.

3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

- a. Tile floors in wet areas.
 - b. Tile floors in toilet rooms.
 - c. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
- 1. Floor Tile: Minimum as recommended by manufacturer.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
- 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- J. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- K. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

3.4 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F113: Thin-set mortar; TCA F113.
 - a. Tile Type: See Drawings.
 - b. Thin-Set Mortar: Dry-set or Latex- portland cement mortar.
 - c. Grout: Sand-portland cement grout.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical tiles and concealed suspension systems for ceilings.

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. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Evaluation reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP.
- 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 typical ceiling area 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class C materials.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL TILE CEILINGS, GENERAL

- A. Low-Emitting Materials: Acoustical tile ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Acoustical Tile Standard: Comply with ASTM E 1264.
- C. Metal Suspension System Standard: Comply with ASTM C 635.
- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL TILES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.; Kitchen Zone 24" x 24" tiles.
- B. Classification: ASTM E 1264.
- C. Color: White.
 - 1. Type III, mineral base with painted finish; Form 1, modular.
- D. LR: not less than .83.
- E. NRC: not less than .60, Type E-400 mounting according to ASTM E 795.
- F. CAC: not less than 35.
- G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.
- H. Thickness: 3/4 inch (19 mm).
- I. Modular Size: 24 by 24 inches (610 by 610 mm) or as indicated on Drawings.

2.4 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation.
 - 3. Chicago Metallic Corp.

- B. Structural Classification: Heavy-duty system - aluminum.
 - 1. Install hold-down clips in all areas.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install acoustical tile ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.
- C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Resilient Base:
 - 1. 6" cove base; Roppe; Color 178 Pewter. VERIFY WITH OWNER.
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 6 inches (102 mm).

- E. Lengths: Coils in manufacturer's standard length.
- F. Finish: As selected by Architect from manufacturer's full range.
- G. Colors and Patterns: As selected by Architect from full range of industry colors.

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 manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 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 and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

- E. Do not stretch resilient base during installation.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096723 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. High-performance resinous flooring systems.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.
- C. Material Certificates: For each resinous flooring component, from manufacturer.
- D. Maintenance Data: For maintenance manuals.
- E. Samples: Submit two 6" X 6" samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.
- F. Product Schedule: For resinous flooring.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - 2. Installer Letter of Qualification: Installer to provide letter stating that they have been in business for at least 5 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.
- D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
 - 1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
 - 2. Finish surfaces for verification of products, color, texture, and sheen.
 - 3. Simulate finished lighting conditions for Architect's review of mockups.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
 - 5. Mockup shall demonstrate desired slip resistance for review and approval by Owner's representative in writing.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by:
 - 1. The Sherwin Williams Company, Cleveland, OH. swflooring@sherwin.com
- B. **Resuflor Deco Flake BC, 20-30 mils nominal thickness.**
 - 1. Primer: Resuprime 3579 at 200-300 sq. ft. per gallon.
 - 2. Body Coat: Resuflor 3746 at 200-300 sq. ft. per gallon.
 - 3. Broadcast: Decorative Flakes 6750 or 6755 to excess at 100-200 lbs. per 1,000 sq. ft.
 - 4. Grout Coat: Resuflor 3746 at 160-250 sq. ft. per gallon.
 - 5. Seal Coat: Resutile 4686 at 250-400 sq. ft. per gallon.

2.2 MATERIALS

- A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
 - 1. Resinous Flooring: 100 g/L.

2.3 HIGH-PERFORMANCE RESINOUS FLOORING

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
- B. System Characteristics:
 - 1. Color and Pattern: As indicated from manufacturers listed above.
 - 2. Slip Resistance: Provide slip resistant finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.
- B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:

- C.
 - 1. **Thin film, to 10 mils** **CSP-1 to CSP-3**
 - 2. Thin and medium films, 10 to 40 mils CSP-3 to CSP-5
 - 3. Self-leveling mortars, to 3/16" CSP-4 to CSP-6
 - 4. Mortars and laminates, to 1/4" or more CSP-5 to CSP-10
- D. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests indicated below.
 - a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq. ft.
 - b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

- A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.
- B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
- C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

- A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
 - 1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
 - 2. Install topcoat over flooring after excess aggregate has been removed.
 - 3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.
- B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
- D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- E. Slip Resistant Finish: Provide grit for slip resistance.
- F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 COMPLETED WORK

- A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.
- B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes modular, tufted carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.
 - d. Follow manufacturer's modular carpet installation guidelines and/or Carpet & Rug Institute Installation Standard 2011 where applicable.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written specifications and lab documents for any physical testing.
 - 2. Include installation recommendations for each type of substrate as specified in carpet manufacturer's installation guidelines and/or Carpet & Rug Institute Installation Standard 2011, where applicable.
 - 3. Include carpet maintenance recommendations as outlined by the carpet manufacturer.
 - 4. Carpet Manufacturer shall also submit a plan for recycling the specified carpet at the end of the useful life of the carpet.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.

4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
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.

E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Platinum points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles, include the following in maintenance manuals:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 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 10.67 sq. yd. (8.9 sq. m).

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An installer with a minimum of 5 years' commercial carpet installation experience.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with carpet manufacturer's installation recommendations and the Carpet & Rug Institute Installation Standard 2011 where applicable.

1.10 FIELD CONDITIONS

- A. Comply with carpet manufacturer's installation recommendations and the Carpet & Rug Institute Installation Standard 2011 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. HVAC system should be operational and running prior to carpet installation and remain running after carpet installation.
- D. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to allow bond between adhesive and concrete. Concrete slabs should have moisture and pH readings that are within the specified tolerance of the adhesive to be used.
- E. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 2. Failures include, but are not limited to, more than 10 percent face fiber loss, edge raveling, dimensional instability, excess static discharge, loss of tuft bind strength, delamination, and where face fiber is 100 percent solution dyed, inability to remove acid based stains, lack of colorfastness to atmospheric contaminants.
 3. Carpet must be manufactured and warranted by same manufacturer.
 4. Warranty Period: Lifetime Commercial Limited Warranty.

PART 2 - PRODUCTS

2.1 CARPET TILE - CPT

Basis-of-Design Product: Shaw Entrée 24" x 24" tile.

A. Source Limitations:

1. Single Source Responsibility: Provide products that have components manufactured by a single source. Fiber and backing, as well as final carpet product, should be manufactured and warranted by same company.
2. Commitment to sustainability: Carpet manufacturer must practice environmental responsibility through programs of source reduction, recycling, reuse, and conservation.

B. Color: 31549 Charcoal..

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Trowelable Adhesives: Water-resistant, mildew-resistant, nonstaining, premium grade, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation such as Shaw 5000 or Shaw 5100 or available equivalent where slab moisture does not exceed 85 percent per ASTM F 2170 or 5 lbs per ASTM F 1869. Where slab moisture does not exceed 85 percent and antimicrobial protection is needed to pass AATCC 174, use Shaw 5036. Where moisture exceeds 85 percent or 5 lbs but does not exceed 90 percent or 10 lbs, use Shaw 5900 or available equivalent.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Adhesives shall comply with the testing and product requirements of the Carpet and Rug Institute Green Label Plus Program.

C. Non-Trowelable Adhesive: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation such as LokDots where slab moisture does not exceed 95 percent per ASTM F 2170 or 10 lbs per ASTM F 1869. Each carpet tile must be adhered to the subfloor.

D. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other

conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects prior to installation. See manufacturer's requirements for substrate conditions and ambient conditions.

- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing moisture and pH tests as recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 4. Lightweight concrete and gypcrete subfloors may require a primer such as Shaw 9050 or equivalent to reduce surface porosity.
 - 5. Where previous surface treatments are unknown, or where other concerns exist as to the ability of the adhesive to bond to the substrate, a 24-hour bond test is recommended.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with Carpet & Rug Institute Installation Standard 2011, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds that contain a cementitious base with a latex additive, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with Carpet & Rug Institute installation Standard 2011, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive, such as LokDots. Any non-spreadable adhesive system must adhere the carpet to the substrate.
- C. Maintain dye lot integrity. Do not mix dye lots in same area unless the specific carpet style in manufactured as a merg-able dylot product.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.
- H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.
- I. Roll the entire installation with a 75 lb roller once installation is completed.

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 Carpet & Rug Institute Installation Standard 2011, "Protecting Indoor Installations."
- C. When construction or move-in activities will continue where new carpet is installed, provide non-staining building material paper to protect carpet. Do not use plastic sheeting as it can trap moisture, and self-sticking plastic sheeting can transfer adhesive residue to carpet that will attract soil.
- D. When heavy objects are moved over carpet within 24 hours of installation, use plywood over carpet to prevent buckling and wrinkling.
- E. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on exposed exterior and interior items and surfaces.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples 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 specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 PROJECT CONDITIONS

- A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

- C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- C. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Benjamin Moore & Co. (Benjamin Moore).
 - 2. Kelly-Moore Paint Co. (Kelly-Moore).
 - 3. PPG Industries, Inc. (Pittsburgh Paints).
 - 4. Sherwin-Williams Co. (Sherwin-Williams).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
 - 1. Flat Paints and Coatings: VOC not more than 50 g/L.
 - 2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
 - 3. Anticorrosive Coatings: VOC not more than 250 g/L.
 - 4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.

5. Stains: VOC not more than 250 g/L.
6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
7. Restricted Components: Paints and coatings shall not contain acrolein; acrylonitrile; antimony; benzene; butyl benzyl phthalate; cadmium; di (2-ethylhexyl) phthalate; di-n-butyl phthalate; di-n-octyl phthalate; 1,2-dichlorobenzene; diethyl phthalate; dimethyl phthalate; ethylbenzene; formaldehyde; hexavalent chromium; isophorone; lead; mercury; methyl ethyl ketone; methyl isobutyl ketone; methylene chloride; naphthalene; toluene (methylbenzene); 1,1,1-trichloroethane; or vinyl chloride.

D. Colors: As selected from manufacturer's full range.

2.3 PREPARATORY COATS

- A. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.
 2. Zinc-Coated Metal Substrates: Galvanized metal primer.
 3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.
- B. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
 2. Zinc-Coated Metal Substrates: Galvanized metal primer.
 3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

2.4 EXTERIOR FINISH COATS

- A. Exterior Semigloss Acrylic Enamel:
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170.
 2. Kelly-Moore; 1250 Acry-Lustre Exterior Semi-Gloss Acrylic Finish.
 3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint.
 4. Sherwin-Williams; A-100 Latex Gloss A8 Series.

2.5 INTERIOR FINISH COATS

- A. Interior Low-Luster Acrylic Enamel:
1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274.
 2. Kelly-Moore; 1610 Sat-N-Sheen Interior Latex Low Sheen Wall and Trim Finish.
 3. Kelly-Moore; 1686 Dura-Poxy Eggshell Acrylic Enamel.
 4. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel.
 5. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 - 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Material Preparation:
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- G. Sand lightly between each succeeding enamel or varnish coat.
- H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Omit primer over metal surfaces that have been shop primed and touchup painted.
 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
- I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- M. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- O. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
- P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

3.2 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.
- D. Ferrous Metal:
 - 1. Acrylic Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).
 - b. Finish Coats: Exterior semigloss acrylic enamel.

3.3 INTERIOR PAINT SCHEDULE

- A. Veneer Plaster:
 - 1. Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.
- B. Ferrous Metal:
 - 1. Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.
- C. CMU:
 - 1. Concrete Block: CMU three coats.
 - a. Block Filler.
 - b. Low-luster enamel.
 - c. Low-luster enamel.

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Panel signs.

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.
- C. Shop Drawings: Show fabrication and installation details for signs.
1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
 3. Sign Schedule: Use same designations specified or indicated on Drawings or in sign schedule.
- D. Samples for Verification: Full size sample for each sign type and for each color and texture required.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allenite Signs; Allen Marking Products, Inc.
 2. APCO Graphics, Inc.
 3. ASI-Modulex, Inc.

4. Best Sign Systems Inc.
 5. Bunting Graphics, Inc.
 6. InPro Corporation
 7. Matthews International Corporation; Bronze Division.
 8. Mills Manufacturing Company.
 9. Mohawk Sign Systems.
- B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
1. Acrylic Sheet: 0.080 inch (2.03 mm) thick.
 2. Edge Condition: Square cut.
 3. Corner Condition: Square.
 4. Mounting: Unframed.
 - a. Wall mounted with two-face tape.
 - b. Manufacturer's standard anchors for substrates encountered.
 5. Color: As selected by Architect from manufacturer's full range.
 6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Panel Material: Opaque acrylic sheet.
 2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).
- D. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
1. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.
- E. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for three years for application intended.
1. Color: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic

manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for three years for application intended.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - 2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 3. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

END OF SECTION 101400

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-plastic toilet compartments.

1.2 ACTION SUBMITTALS

- A. Product data. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions.
 - 2. Installation methods.
- B. Shop Drawings: Plans, elevations, sections, details, and attachment details including hardware information. Show centerlines of toilet fixtures.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.
- D. Samples for Verification: Two actual samples of finished products for each type or toilet compartment in manufacturer's standard sample size.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data for toilet compartments.

1.4 FIELD CONDITIONS

- A. Field measurements: Verify actual locations of toilet fixtures, walls, columns and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

1.5 WARRANTY

- A. Manufacturer guarantees plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286 and ASTM E 84, Class B.
- B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.
- C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", ICC A117.1, and 2018 Illinois Accessibility Code for toilet compartments designated as accessible.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AJW Architectural Products.
 - 2. ASI Global Partitions.
 - 3. All American Metal Corp.
 - 4. American Sanitary Partition Corporation.
 - 5. General Partitions Mfg. Corp.
 - 6. Hadrian Inc.; Zurn Industries, LLC.
 - 7. Knickerbocker Partition Corporation.
 - 8. Metpar Corp.
 - 9. Scranton Products.
- B. Toilet-Enclosure Style: Floor anchored **Overhead braced**.
- C. Urinal-Screen Style: **Wall hung**.
- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch (25 mm) thick, seamless, with eased edges, with pebble-textured finish, and with homogenous color throughout thickness of material. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door.
 - 1. Heat-Sink Strip: Manufacturer's continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 2. Color: One color in each room as selected by Architect from manufacturer's full range.
- E. Urinal-Screen Construction: Matching panel construction.

- F. Pilaster Shoes: Manufacturer's standard design; Stainless steel. 3 inches (76 mm), 20 gauge stainless steel. Secured to pilasters with a stainless steel tamper resistant Torx head sex bolt.
- G. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum.

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. **Mount with through bolts.**
 - 1. Hinges:
 - a. Manufacturer's continuous, cam type that swings to a closed or partially open position.
 - 1) Material, Continuous Hinge: Stainless steel.
 - 2. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
 - a. Material: Aluminum or Stainless steel.
 - 3. Door Bumper /Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - a. Material: Aluminum or stainless steel.
 - 4. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
 - a. Material: Stainless steel.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet enclosures and 32-inch- (813-mm-) wide, outswinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch (13 mm).
 - b. Panels or Screens and Walls: 1 inch (25 mm).
 - 2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102116.19 - PLASTIC SHOWER AND DRESSING COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic shower and dressing compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking and overhead support of floor-and-ceiling-anchored compartments.
2. Section 092216 "Non-Structural Metal Framing" for blocking.
3. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.
4. Section 105113 "Metal Lockers" for dressing compartment benches.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: Plans, elevations, sections, and attachment details.

C. Samples: Manufacturer's standard color sheets, showing full range of available finishes for each type of compartment.

D. Delegated Design Submittals: For grab bars mounted on compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Material test reports.

B. Delegated design engineer qualifications.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in Illinois where Project is located and who is experienced in providing engineering services of the type indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to provide structural design calculations for grab bars, shower seats, or seats of accessible benches mounted on shower or dressing compartment panels.
- C. Structural Performance: Where grab bars, shower seats, or accessible benches are mounted on shower or dressing compartment panels, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar, shower seat, or seat of accessible bench of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.
- D. Regulatory Requirements: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design", ICC A117.1, and Illinois accessibility regulations for shower and dressing compartments designated as accessible.

2.2 SOLID-PLASTIC SHOWER AND DRESSING COMPARTMENTS

- A. Configuration: Shower and dressing compartment(s) as indicated on Drawings.
- B. Compartment Style: Floor and ceiling anchored, privacy type.
- C. Panel Construction: Solid, HDPE panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges and with homogenous color throughout thickness of material.
 - 1. Continuous Hinges: Configure doors and pilasters to receive continuous hinges.
 - 2. Heat-Sink Strip: Manufacturer's continuous, stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 3. Color: One color in each room; as selected by Architect from manufacturer's full range. Protect exposed surfaces from damage by applying strippable, temporary protective covering before shipment.
- D. Pilaster Construction: Match panels.
- E. Door Construction: Match panels. Equip door and pilasters with lapped edge no-sightline system.
- F. Pilaster Shoes: Manufacturer's standard design; stainless steel.
- G. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.
- H. Brackets (Fittings):
 - 1. Shower Compartment Brackets:

- a. Full-Height (Continuous) Type: Manufacturer's standard design; extruded aluminum.
- 2. Dressing Compartment Brackets:
 - a. Continuous U-bracket or manufacturer standard; stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.
 - 1. Hinges:
 - a. Manufacturer's paired, wraparound, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
 - 1) Material, Paired Hinge: Aluminum.
 - b. Manufacturer's continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
 - 1) Material, Continuous Hinge: Stainless steel.
 - c. Manufacturer's integral hinge for solid-plastic doors, allowing emergency access by lifting door.
 - 1) Material, Integral Hinge: Nylon gravity cam unit with stainless steel pins/screws.
 - d. Manufacturer's standard hinge.
 - 2. Latch and Keeper: Manufacturer's surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at each compartment, accessible or not.
 - a. Material: Stainless steel.
 - 3. Clothing Hooks: Manufacturer's clothing hooks in each dressing compartment; include one combination hook and rubber-tipped bumper at inswinging doors, sized to prevent door from hitting wall panel or compartment-mounted accessories.
 - a. Material: Stainless steel.
 - 4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.
 - a. Material: Stainless steel.
 - 5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
 - a. Material: Stainless steel.
- B. Overhead Bracing: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with antigrip profile; in manufacturer's standard finish.
- C. Headrail with Hooks: Manufacturer's standard, continuous, extruded-aluminum headrail or cap with curtain hooks running in concealed track; with antigrip profile; in manufacturer's standard finish.
- D. Curtain Rod with Hooks: Manufacturer's standard, 1-inch- (25-mm-) diameter, stainless steel curtain rod with matching hooks.

- E. Curtain: Flame-resistant, manufacturer's standard fabric that is stain resistant, self-sanitizing, antistatic, antimicrobial, and launderable to a temperature of not less than 90 deg F (32 deg C).
 - 1. Flame Resistance: Passes NFPA 701 tests when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Labeling: Identify fabrics with appropriate markings of applicable testing and inspecting agency.
 - 3. Length: Where curtain extends to a floor surface, size so that bottom hem clears finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) above floor surface. Where curtains extend to a shower-receptor curb, size so that bottom hem hangs above curb line and clears curb line by not more than 1/2 inch (13 mm).
 - 4. Color and Pattern: As selected by Architect from manufacturer's full range.
- F. Soap Holder:
 - 1. Manufacturer's standard, stainless steel soap dish.
- G. Anchorages and Fasteners: Manufacturer's standard, exposed fasteners of stainless steel, chrome-plated steel, or solid brass, finished to match the items they are securing; with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. Use countersunk, flush-type bolt heads or otherwise make fasteners inconspicuous if exposed on opposite side of panel from hardware or accessory item. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.
- E. Zamac: ASTM B86, commercial zinc-alloy die castings, chrome plated.

2.5 FABRICATION

- A. Fabricate shower and dressing compartment components to sizes indicated.
- B. Overhead-Braced Compartments: Manufacturer's standard, corrosion-resistant supports, leveling method, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling method.
- C. Floor-and-Ceiling-Anchored Compartments: Manufacturer's standard, corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- D. Door Sizes and Swings: As indicated on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF SOLID-PLASTIC SHOWER AND DRESSING COMPARTMENTS

- A. General: Comply with manufacturer's written installation instructions. Install compartments rigid, straight, level, and plumb. Secure compartments in position with manufacturer's recommended anchoring devices.
 - 1. Clearances for Dressing Compartments: Maximum 1/2 inch (13 mm) between pilasters and panels; 1 inch (25 mm) between panels and walls.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-and-Ceiling-Anchored Compartments: Secure pilasters to supporting construction, and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.
- C. Curtains: Install curtains to specified length and verify that they hang vertically without stress points or diagonal folds.

3.2 ADJUSTING AND CLEANING

- A. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.
- B. Hardware Adjustment: Clean, adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.
- C. Clean exposed surfaces of compartments after removing strippable, temporary protective covering. Comply with manufacturer's written instructions for stripping of temporary protective covering and cleaning. Replace damaged or defective items.

END OF SECTION 102116.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Private-use bathroom accessories.
 - 4. Hand dryers.
 - 5. Underlavatory guards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
- C. Delegated Design Submittals: For **grab bars and shower seats**.
 - 1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 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. Warranty Period: **15** years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Seven** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
 - 2. Shower Seats: Installed units are able to resist **360 lbf (1601 N)** concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser: Provided by Owner, installed by Contractor.
 - 1. Description: See Drawings.
 - 2. Mounting: Partition mounted, serving two adjacent toilet compartments and/or Surface mounted.
- B. Soap Dispenser Provided by Owner, installed by Contractor.
 - 1. Description: See Drawings.
- C. Grab Bar:
 - 1. Mounting: Flanges with concealed fasteners.
 - 2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 3. Outside Diameter: **1-1/2 inches (38 mm)**.
 - 4. Configuration and Length: As indicated on Drawings.
- D. Sanitary-Napkin Disposal Unit Provided by Owner, installed by Contractor.
 - 1. Description: See Drawings.
- E. Mirror Unit:
 - 1. Description: See Drawings
 - 2. Frame: Stainless steel channel.
 - a. Corners: Mitered and mechanically interlocked.
 - 3. Size: As indicated on Drawings.

4. Glass: Tempered glass.
5. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

F. Hook:

1. Description: Combination door bumper and coat hook.
2. Mounting: Concealed.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Folding Shower Seat:

1. Configuration: L-shaped seat, designed for wheelchair access.
2. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
3. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Dimensions: See Drawings.

2.4 HAND DRYERS

A. High-Speed Air Dryer:

1. Description: High-speed, warm-air hand dryer for rapid hand drying. Model XL-W Xlerator as manufactured by Excel Dryer Inc., or approved equal.
2. Mounting: **Semirecessed**.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard: **Provide at all lavatories.**

1. 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.
2. Material and Finish: Antimicrobial, molded plastic, white.

2.6 FABRICATION

- A. 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 in accordance with 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.
1. Remove temporary labels and protective coatings.

- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire protection cabinets for fire extinguishers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Maintenance data.

1.3 QUALITY ASSURANCE

- 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.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Sheet: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Shapes: ASTM B 221 (ASTM B 221M).
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fire End & Croker Corporation.

- b. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - c. Larsen's Manufacturing Company.
 - d. Modern Metal Products, Division of Technico Inc.
 - e. Moon-American.
 - f. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Aluminum sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- E. Cabinet Trim Material: Aluminum sheet.
- F. Door Material: Aluminum sheet.
- G. Door Style: Center glass panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- 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. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical As indicated on Drawings.
- K. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet door, and trim.
 - b. Interior of cabinet and door.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.
- B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply vinyl lettering at locations indicated.
- E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.
- C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.

- c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type: UL-rated 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
- 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Removal and disposal of existing lockers, trim, and associated items and accessories as noted on drawings.
 - 2. Welded athletic lockers.
 - 3. HDPE Locker benches and screen walls.
 - 4. HDPE Locker tops.
 - 5. Wood Blocking: Reuse if possible and provide new if needed.
 - 6. Add concrete bases as shown on drawings.
- B. Related Work by Others: Padlocks will be provided by Owner.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- E. Samples for Verification: For the following products, in manufacturer's standard size.
 - 1. Lockers.
 - 2. HDPE locker benches.
 - 3. HDPE locker tops.

- F. Product Schedule: For Lockers. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Standards: Comply with the State of Illinois Accessibility Code and Americans with Disabilities Architectural Guidelines (ADAG).
- B. Sources of Supply: A single manufacturer for all lockers of the Section.
- C. Accessory Items: All necessary mounting accessories, fittings, and fastenings shall be as recommended by locker manufacturer.

1.8 MANUFACTURERS

- A. Source Limitations:
 - 1. Obtain metal lockers and accessories from single source from single locker manufacturer.
 - 2. Obtain locker benches and accessories from single source from single manufacturer.

1.9 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.10 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.11 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. Provide (20) Identification Plates and (10) single hooks and (10) double hooks.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.13 FIELD CONDITIONS

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

1.14 COORDINATION

- A. Coordinate sizes and locations of concrete 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.

1.15 WARRANTY

- A. Metal Locker 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 Welded Metal Lockers: Lifetime from date of Substantial Completion.
- B. HDPE Locker Benches and Tops: Provide manufacturer's 25-year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - 2. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
- B. Steel for Doors and Door Frames: Cold-rolled sheet steel, free from buckle, scale, and surface imperfections and capable of producing a smooth, high-grade enamel finish.

- C. Steel for Other Parts: Cold-rolled or annealed, specially treated steel, free from buckle, scale, and surface imperfections and shall be capable of receiving a high grade enamel finish.
- D. Wood Blocking: 2x common Southern Yellow Pine or equivalent Douglas Fir.
- E. Concrete: "High Strength Concrete Mix" by Sakrete.
- F. Fasteners:
 - 1. Bolts: Cadmium, zinc or nickel-plated steel; dry and free of lubricants. Exposed bolt heads shall be slotless type. Provide self-locking nuts or lock washers for nuts if not otherwise installed to prevent loosening of nuts. Nuts exposed to touching shall be acorn type.
 - 2. Rivets: Non-corroding pop rivets.
 - 3. Screws: Sheet metal type of cadmium, zinc or nickel-plated steel; dry and free of lubricants. No screws shall be used where points may be exposed to touching.
- G. Solid Plastic for Locker Benches, Designated Locker Tops and Screen Walls: HDPE solid plastic fabricated from polymer resins compounded under high pressure, forming single thickness panel.

2.2 WELDED ATHLETIC LOCKERS

- A. Acceptable Model & Manufacturer: Model AMP 1004 Athletic Bulldog Twin Frame All Welded Lockers by Art Metal Products, or comparable products of Debourgh. If other manufacturers wish to be approved, a full size sample needs to be submitted during the bidding phase for the Architect to review. The sample needs to meet the specifications listed in this Section.
 - 1. Sizes as listed on Drawings.
- B. General:
 - 1. All lockers shall be factory assembled of all MIG welded construction in multiple column units to meet job conditions.
- C. Locker Materials/Components:
 - 1. Doors: 14 ga. sheet steel.
 - 2. Body:
 - a. Side Panels: 16 ga. sheet steel.
 - b. End Panels: 14 ga. sheet steel.
 - c. Back Panels: 18 ga. sheet steel.
 - 3. Filler Panels: 14 ga. sheet steel.
 - 4. Tops (Flat & Sloped): 16 ga. sheet steel.
 - 5. Shelves: 16 ga. sheet steel.
 - 6. Hinges: 16 ga. continuous piano hinges.
 - 7. Handle: Deep drawn seamless stainless steel recessed handle.
 - 8. Clothes Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

9. Identity Plates: Manufacturer's standard with etched numerals not less than 3/8" high. Plates shall be attached with rivets.
10. Door Strikes: Continuous top, bottom and sides.
 - a. At ADA lockers, provide approved braille identification and universal handicapped symbol permanently affixed to the locker front.
11. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

D. Locker Types: See drawings for locker types and sizes.

E. Finish:

1. All locker parts to be cleaned and coated after fabrication with a seven stage zinc/iron phosphate solution to inhibit corrosion, followed by a coat of high grade enamel electrostatically sprayed and baked at 325 degrees Fahrenheit for a minimum of 30 minutes to provide a touch durable finish. Finish to be a minimum 2-mil. thick.
2. Colors to be selected from manufacturer's standard list of colors.

2.3 LOCKS

A. Combination Padlock: Provided by Owner.

2.4 LOCKER BENCHES, DESIGNATED LOCKER TOPS AND SCREEN WALL

A. Type & Manufacturer: HDPE material as manufactured by Scranton Products or approved equal.

B. Materials:

1. Bench Tops: 1-1/2 inch thick with all edges rounded to 1/4 inch radius. Width and lengths designated on the drawings. Provide ADA benches in locations shown on the Drawings.
2. Pedestals: Pre-finished steel, 16-1/4 inches high, secured to tops with stainless steel tamper resistant Torx head screws and to floor with lead expansion shields and 2-inch long stainless steel machine bolts.
3. Locker Tops: 1-inch thick with all edges rounded to 1/4-inch radius. See drawings for sizes.
4. Screen Wall: 1-inch thick with all edges rounded to 1/4-inch radius. See drawings for sizes.

C. Fabrication: Fabricate locker benches to sizes indicated in single lengths.

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

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. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Equipment: Provide each locker with an identification plate and the following equipment: 2 single and 1 double hook.
 - 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. Triple-Tier Units: One double-prong ceiling hook.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.
- 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. See drawings for locations of ADA lockers.
- F. 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.
- G. Optional - Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.
- 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.
- K. Doors:
 - 1. Outer door to be fabricated from single sheet prime 14 ga. with single bends at top and bottom and double bends at sides.
 - 2. Doors shall include an 18 ga. full height channel door stiffener MIG welded to the hinge side of the door as well as to the top and bottom return bends and spot welded to the inside of door face to form a torque free box reinforcement for the door. Width of stiffener to be 1/3 the door width or a minimum of 3" wide, whichever is greater. Stiffener to be welded a maximum of 6" o.c.
 - 3. Doors shall have sightless secure vents (manufacturer's standard mini-louvers no more than 1-1/2" long top and bottom as shown on elevations.
 - 4. Recessed Locker Handle.
 - a. All locker doors shall have a seamless drawn stainless steel recessed handle shaped to receive a padlock (furnished by Owner).

- b. The recess pan shall be deep enough to have the lock to be completely flush with the outer door face.
- c. The pull handle shall be drawn into the left side of the handle for easy opening of the locker door.

L. Latch Assembly:

- 1. Shall be single point rigid non-moving positive latch by means of a heavy min. 11 ga. latch securely welded to the 16 ga. vertical frame member at both the continuous door strike as well as the integral locker side to prevent the latch and frame from twisting.
- 2. The latch assembly must be made of a single piece of steel and have a padlock loop that inserts through the recess pan.
- 3. The latch must be able to accept a padlock.
- 4. A pry resistant lug which inserts into the door shall be an integral part of the 11 ga. latch.
- 5. Rubber bumpers shall be securely attached to the door strike.

M. Door Hinges:

- 1. Hinges shall be not less than 16 ga. continuous piano type, securely riveted to frame and welded to door. Maximum distance between rivets to be 6" o.c.
- 2. All doors shall be right hand hinged.

N. Twin Frame/Vertical Side Panels:

- 1. Shall be integral frame and side wall construction manufactured from 16 ga. sheet steel.
- 2. The one-piece side/frame shall be formed to provide a continuous door strike on the hinge side.
- 3. An additional continuous vertical door strike shall be achieved at the latch side by MIG welding a 16 ga. full height channel frame member to the integral locker side producing a rigid torque free welded locker body.
- 4. The frame shall include a tab which engages a slot in the base locking the side panel and frame into position.
- 5. Sides shall not be perforated.

O. Hat Shelves, Intermediate Shelves and Bottoms: Shall be 16 gauge sheet steel, have double bends at front and shall be MIG welded to the sides. Bottom to be formed to have a continuous door strike.

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 for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Demolition and Removals:

1. Remove existing lockers, trim and other designated material and legally dispose of it off site.
2. Remove existing locker base and wood blocking from wall and legally dispose of it off site.

B. Bases shall be made level, true and ready as required to receive new lockers:

1. Provide new wood blocking where required.
2. Provide new shims to level and true-up new lockers.
3. Where noted on drawings, add concrete bases:
 - a. Form: Plastic-coated moisture-resistant plywood, metal, or other acceptable type materials providing continuous, straight, smooth, exposed surface.
 - b. Pour concrete mix in form and provide a smooth finish face.

3.2 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 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 and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Identification Plates: Identify metal lockers with identification as selected by Owner.
 - 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.
- E. Fixed HDPE Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- F. Fixed Flat HDPE Locker Tops Where Designated: Install tops on top of lockers and fasten with screws from within the lockers up into the tops. Provide adequate fasteners so the tops are stable.
- G. Fixed HDPE Screen Walls: Install panels onto existing and new pipe railings.

3.4 CLEANING, TOUCH-UP AND ADJUSTING

- A. 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.
- B. Adjust doors and latches to operate easily without binding, lubricate where necessary for proper operation.
- C. Verify satisfactory operation of locking devices.
- D. Upon acceptance of the building, leave lockers free of accumulations of dust, especially louvers and interiors.

3.5 PROTECTION

Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

END OF SECTION 105113

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes pipe, fittings, valves and connections for sprinkler systems.
- B. Related Sections:
 - 1. Section 09 90 00 - Painting and Coating: Execution requirements for piping painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 - 2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
 - 3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 5. ASME B16.25 - Buttwelding Ends.
 - 6. ASME B16.3 - Malleable Iron Threaded Fittings.
 - 7. ASME B16.4 - Gray Iron Threaded Fittings.
 - 8. ASME B16.5 - Pipe Flanges and Flanged Fittings.
 - 9. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
 - 10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
- B. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 3. ASTM A536 - Standard Specification for Ductile Iron Casting.
 - 4. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- C. American Welding Society:
 - 1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
- D. American Water Works Association:
 - 1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
 - 2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - 4. AWWA C606 - American National Standard for Grooved and Shouldered Joints.

E. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. 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.
- C. Product Data: Submit manufacturer's catalogue information. Indicate valve data and ratings.
- D. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series designation.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Plans shall be reviewed by Engineer prior to system installation.
- G. Submit plans, calculations, product data, etc. for cursory review by the local authority, if required.
- H. Final hydraulic calculations are the sole responsibility of the contractor. Any pipe sizing noted on drawings reflects schematic design.
- I. Plans, calculations, product data, etc. to be stamped by fire protection contractor licensed engineer.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and tag numbering.
- C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

- A. Provide fire sprinkler piping located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with UL 1887.
- B. Perform Work in accordance with NFPA 13 and local authority having jurisdiction.
- C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
2. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 31 19 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 25 00 - Product Requirements: Product storage and handling requirements.
- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 WARRANTY

- A. Section 01 77 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 EXTRA MATERIALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.11 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)

- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795; black steel.
 - 1. Steel Fittings: ASME B16.5, steel flanges and fittings.
 - 2. Steel Piping:
 - a. Up to 2 inches shall be Schedule 40 designed working pressure 175 psi.
 - b. 2 1/2 inches and over shall be Schedule 10 designed working pressure 175 psi.
 - 3. Cast Iron Fittings: ANSI B16.1, flanges and flanged fittings; or ANSI B16.4, threaded fittings.
 - 4. Malleable Iron Fittings: ANSI B16.3, threaded fittings.
 - 5. Mechanical Grooved Couplings and Fittings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

2.2 PIPE HANGERS AND SUPPORTS

- A. Conform to NFPA 13.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.3 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges, grooved joint couplings, or unions.
- D. Degrease and clean surfaces to receive adhesive for identification materials or for paint purposes.

3.2 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems.
- 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 pipe sleeve at piping penetrations through partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
 - 1. Install in accordance with NFPA 13.
 - 2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Prime coat exposed steel hangers and supports. Hangers and supports located in pipe shafts, and suspended ceiling spaces are not considered exposed.
- H. Slope piping and arrange systems to drain at low points. Install 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. Do not penetrate building structural members unless indicated.
- K. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.
- L. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- M. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)
- N. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut above slab.
- O. The automatic sprinkler contractor shall be responsible during the installation and testing periods of the sprinkler work, for any damage to the work of the owner or other, and to the property and materials of the owner and others caused by leaks in sprinkler equipment, fittings, sprinkler heads, or by disconnect pipes.
- P. All exposed pipe which passes through a wall or ceiling shall be equipped with an escutcheon plate.
- Q. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering apply paint primer before applying labels.
- R. Identify piping, concealed above ceiling system or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow and direction. Install in clear view and align with axis of piping. 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.
- S. Provide ceiling tacks to locate valves above t-bar type panel ceilings. Locate in corner of panel closest to equipment.
- T. Sprinkler piping shall not be installed directly over any electrical equipment panels. Contractor shall coordinate pipe routing with all existing and new electrical panels.
- U. All exposed piping in finished spaces shall be coordinated with architect and other trades. All exposed piping to be degreased, primed, and painted with two finish coats to match surrounding areas. Refer to architectural drawings for additional information.

3.3 INTERFACE WITH OTHER PRODUCTS**A. Inserts:**

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean entire system after other construction is complete.

END OF SECTION 210500

SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Tags.
2. Pipe markers.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Submittal procedures.****B. Product Data: Submit manufacturers catalog literature for each product required.****C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.****D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.****E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.****1.4 CLOSEOUT SUBMITTALS****A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.****B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.****1.5 QUALITY ASSURANCE****A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.****1.6 QUALIFICATIONS****A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.**

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.9 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 TAGS

- A. Plastic Tags:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.

- c. Seton Identification Products.
 - d. Brimar Industries, Inc.
 - e. Kolbi Pipe Marker Co.
- 2. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter. See drawings for color.

B. Metal Tags:

- 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - d. Brimar Industries, Inc.
 - e. Kolbi Pipe Marker Co.
- 2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

2.2 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

- 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - d. Brimar Industries, Inc.
 - e. Kolbi Pipe Marker Co.
- 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

- 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - d. Brimar Industries, Inc.
 - e. Kolbi Pipe Marker Co.
- 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install tags using corrosion resistant chain. Number tags consecutively by location.
- C. Identify valves in main and branch piping with tags.
- D. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow and direction. Install in clear view and align with axis of piping. 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.
- E. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

- A. Identification:
 - 1. See drawings for details.

END OF SECTION 210553

SECTION 210590 - TESTING OF FIRE SUPPRESSION PIPING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Sprinkler Piping.

1.2 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.
- N. ARI
- O. ASME
- P. NFPA

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION**3.1 GENERAL**

- A. Before final acceptance of all piping system, all systems must be tested in accordance with the schedule and prove to be free of leaks.
 - 1. Perform tests under observation of Architect/Engineer.
 - 2. Underground systems shall be tested prior to backfilling.
 - 3. Remove, replace or satisfactorily repair defective work revealed by tests.
 - 4. Make piping repairs with new materials; caulking of screwed joints or pin holes is not permitted.
 - 5. Furnish all test equipment and materials for testing.
 - 6. Owner to furnish water for testing and flushing.

3.2 TESTING MATERIAL

- A. Testing Medium:
 - 1. Hydrostatic Testing Medium: Clean Water.
 - 2. Pneumatic Testing Medium: Clean compressed air.
- B. Pressure Testing Gauges: ANSI B40.1, Grade AA; minimum 6 inch diameter dial with scale divisions equal or less than maximum allowable pressure drop.

3.3 TESTING SYSTEMS

- A. Fire Protection System:
 - 1. Test entire fire protection piping systems as scheduled and prove tight.
 - 2. Where portion of fire protection piping system is concealed before completion, test that portion separately as specified for entire system.
- B. Hydrostatic and Pneumatic Testing Requirements:
 - 1. Hydrostatic and pneumatic tests apply to piping indicate as scheduled in Paragraph C.
 - 2. Pressure to be raised gradually to given value; then block off tight at source.
 - 3. Allowable Pressure Drop: Maximum amount scheduled during corresponding minimum time interval.
 - a. Visually examine all joints during test.
 - 4. Upon successful completion and test approval, relieve piping of pressure, drain, put into normal operation except for potable water to be sterilized before placing in service.

C. Hydrostatic and Pneumatic Testing Schedule:

	Normal Work Pressure <u>psig</u>	Hydrostatic Test Pressure <u>psig</u>	Pneumatic Test Pressure <u>psig</u>	Maximum Allowable Pressure Drop <u>psig</u>	Minimum Test Time <u>Hours</u>
<u>Service</u> Fire Protection Piping	To 125	200	---	2	2

3.4 CLEANING AND ADJUSTING

A. Cleaning: Thoroughly clean all parts of the piping installation at completion of work.

1. Remove grease, metal cutting and sludge from all equipment, pipes, valves all fittings.
2. Repair all stoppages, discoloration or other damage to finish, furnishings or parts of building that are due to Contractor's failure to properly clean piping system.

B. Adjusting:

1. Adjust control devices for proper operation.
2. Demonstrate to Architect/Engineer satisfactory operation following adjustment.
3. Readjust or replace all items not functioning properly.

END OF SECTION 210590

SECTION 211313 - WET PIPE SPRINKLER SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes wet-pipe sprinkler system, system design, installation, and certification.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

- A. National Fire Protection Association:
- B. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

- A. Provide hydraulically designed system to NFPA 13 occupancy requirements.
- B. Determine volume and pressure of incoming water supply from water flow test data.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
- C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Submit plans, calculation, product data, etc. for cursory review by the local authority, if required. Plans, calculations, product data, etc. shall be submitted to architect/engineer prior to system installation.
- E. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- F. Design Data: Submit design calculations; signed and sealed by sprinkler contractor's professional engineer.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13 and local authority having jurisdiction.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Illinois.

1.8 PRE-INSTALLATION MEETINGS

- A. Section 01 31 19 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 25 00 - Product Requirements: Product storage and handling requirements.
- B. Store products in shipping containers until installation.
- C. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

- A. Section 01 77 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish extra sprinklers under provisions of NFPA 13.
- C. Furnish suitable wrenches for each sprinkler type.

- D. Furnish metal storage cabinet located adjacent to riser.

1.12 REQUIREMENTS REGULATORY

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 SPRINKLERS

- A. Suspended Acoustical Ceiling or Suspended Gypsum Ceiling:
 - 1. Type: Semi-recessed pendent type.
 - 2. Sprinkler Head Finish: White Polyester.
 - 3. Escutcheon Finish: Matching White Enamel.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Areas of No Ceilings:
 - 1. Type: Brass pendent or upright.
 - 2. Sprinkler Head Finish: Brass.
 - 3. Fusible Link: Glass bulb type temperature rated for specific area.

- C. Sprinklers shall be glass bulb type, with hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.
 - 1. Wrenches shall be provided by the sprinkler manufacturer that directly engages the hex-shaped wrench boss integrally cast in the sprinkler body.
- D. Guards: Finish to match sprinkler finish.
 - 1. Guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
- E. Sprinklers subject to mechanical injury, such as in mechanical rooms, storage rooms, janitor closets, open structure (no ceilings) of locker rooms, etc. shall be protected with listed guards.
- F. All sprinklers shall be quick response. The use of extended coverage sprinklers will be permitted; however, all extended coverage sprinklers shall be quick response. Extended coverage sprinkler heads may be use only if it does not affect other trades devices in the ceilings. This must be coordinate with all trades and architect prior to acceptance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Place pipe runs to minimize obstruction to other work.
- C. Install piping in concealed spaces above finished ceilings.
- D. Flush entire piping system of foreign matter.
- E. Center sprinklers in two directions in ceiling tile and install piping offsets.
- F. Hydrostatically test entire system per NFPA 13 and NFPA 25.
- G. Require test be witnessed by Authority having jurisdiction.
- H. Inspectors test connections shall be located as shown on drawings.
- I. All pipe, fittings, valves, etc. shall be installed in a rust-free condition.
- J. Placards displaying pertinent hydraulic data shall be affixed to all new system risers.
- K. All piping and components necessary for installation may be fabricated. However, the contractor must be willing to rework the prefabricated piping, fittings, and the like, as necessary to constitute a proper approved installation, existing site conditions notwithstanding, at no additional cost to the owner.
- L. Contractor to provide adequate sprinkler coverage per NFPA 13 to all areas indicated on the drawings. Coordinate sprinkler head locations with architectural drawings, lighting plans and all other trades.

- M. Contractor is responsible to provide the appropriate temperature rated sprinkler heads per NFPA based on the room use and types of heat generating equipment within the room. Refer to architectural drawings and other trade drawings for additional information on room use and heat generating equipment.
- N. Sprinkler piping shall not be installed directly over any electrical equipment panels. Contractor to coordinate routing with all existing and new electrical panels.
- O. Coordinate sprinkler head placement in ceiling with mechanical supply diffusers, radiant ceiling panels, cabinet unit heaters or any ceiling mounted heat generating equipment. Sprinkler heads shall not be placed directly adjacent to these devices and have the required separation to prevent a false sprinkler head discharge.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Final cleaning.
- B. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 77 00 - Execution and Closeout Requirements: Protecting installed construction.
- B. Properly cover/protect sprinkler heads, escutcheons, etc. from field painting of walls, ceilings, adjacent surfaces, etc. with masking tape or paper. Remove masking tape or paper after painting is completed. Replace all painted sprinkler heads and escutcheons with new.

END OF SECTION 211313

SECTION 220503 - PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes: Pipe and pipe fittings for the following systems:**

1. Domestic water piping within 5 feet of building.
2. Domestic water piping, above grade.
3. Sanitary sewer piping within 5 feet of building.
4. Sanitary sewer piping, above grade.
5. Equipment drains and over flows.
6. Unions and flanges.
7. Underground pipe markers.
8. Bedding and cover materials.

B. Related Sections:

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
2. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.
3. Refer to civil drawings for additional information - Soils for Earthwork: Soils for backfill in trenches.
4. Refer to civil drawings or civil specifications for additional information - Aggregates for Earthwork: Aggregate for backfill in trenches.
5. Refer to civil drawings civil specifications for additional information - Excavation: Product and execution requirements for excavation and backfill required by this section.
6. Refer to civil drawings civil specifications for additional information - Trenching: Execution requirements for trenching for underground piping systems.
7. Refer to civil drawings civil specifications for additional information - Fill: Execution requirements for backfilling required by this section.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
9. ASME B31.9 - Building Services Piping.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

11. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
8. ASTM B32 - Standard Specification for Solder Metal.
9. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
10. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
11. ASTM B75 - Standard Specification for Seamless Copper Tube.
12. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
13. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
14. ASTM B302 - Standard Specification for Threadless Copper Pipe.
15. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
16. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
17. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
18. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
19. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
20. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
21. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
22. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
23. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
25. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

D. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

- B. Coordinate installation of buried piping with trenching.

1.10 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Ductile Iron Pipe: AWWA C151.
 - 1. Fittings: AWWA C110, ductile iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
- B. Copper Tubing: ASTM B88, Type K annealed.
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
- C. Copper Tubing: ASTM B42, hard drawn or annealed.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

- A. (Pipe size 3/4" - 6") - Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade 95TA.

2.3 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

- B. Ductile Iron Pipe: ASTM A746, service weight, bell and spigot ends.

1. Fittings: AWWA C110, ductile iron, standard thickness.
2. Joints: AWWA C111, rubber gasket joint devices.

- C. PVC Pipe: ASTM D2665, Polyvinyl Chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.4 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron, ASTM A74.
2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

- C. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.

1. Fittings: ASTM D2665, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
3. **Note: PVC can be installed if allowed by local authority having jurisdiction.**
4. **Note: PVC piping is not allowed in mechanical return plenum ceilings. Refer to mechanical drawings for locations of return plenums.**

2.5 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.

1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.

2. Joints: Threaded for pipe 2 inches and smaller.

B. Copper Tubing: ASTM B88, Type DWV, K, L, or M, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

C. PVC Pipe: ASTM D1785, Schedule 40.

1. Fittings: ASTM D2466, Schedule 40, PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered joints.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
4. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. PVC Piping: PVC flanges.
4. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.7 UNDERGROUND PIPE MARKERS

- A. Furnish materials in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.
- B. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil. thick, manufactured for direct burial service.
- C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Domestic Water Service or Sewer Service" in large letters.

2.8 BEDDING AND COVER MATERIALS

- A. Bedding: Refer to civil drawings or civil specifications for additional information.
- B. Cover: Refer to civil drawings or civil specifications for additional information.
- C. Soil Backfill from Above Pipe to Finish Grade: Refer to civil drawings or civil specifications for additional information.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.
- C. Verify trenches are ready to receive piping.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system size, location, and invert as indicated on Drawings.
- B. Establish elevations of buried piping per drawings.
- C. Excavate pipe trench in accordance with civil drawings.
- D. Install pipe to elevation as indicated on Drawings.
- E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches.
- F. Install pipe on prepared bedding.
- G. Route pipe in straight line.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Install shutoff and drain valves at locations indicated on Drawings in accordance with Section 22 05 23.
- J. Install plastic ribbon tape continuous over top of pipe. Buried 6 inches below finish grade, above pipe line; refer to civil drawings or civil specifications for additional information. Refer to Section 22 05 53.
- K. Pipe Cover and Backfilling:
 - 1. Backfill trench: refer to civil drawings or civil specifications for additional information.

2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping

- L. Install Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
- G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.
- H. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients unless noted otherwise on drawings.
- J. Slope piping and arrange systems to drain at low points.
- K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Install valves in accordance with Section 22 05 23.
- N. Install piping specialties in accordance with Section 23 21 16.
- O. Insulate piping. Refer to Section 22 07 00.
- P. Install pipe identification in accordance with Section 22 05 53.
- Q. Sleeve pipes passing through partitions, walls and floors.

- R. Plumbing contractor is responsible for all cutting and patching of existing walls/floor required to perform any new or demolition plumbing work.
- S. PVC piping is not allowed in mechanical return plenum ceilings. Refer to mechanical drawings for locations of return plenum ceilings.
- T. When PVC is used at sanitary applications, all vertical and horizontal piping shall be insulated.
- U. PVC shall not be used for any sanitary drainage piping capable of receiving waste with a temperature exceeding 120 degrees. PVC serving floor drains in mechanical room with boilers or water heaters will not be accepted.
- V. All piping, fittings and joints shall comply with the Local Amendments and the Authority having Jurisdiction. Materials listed in specification that do not comply with these amendments shall not be used in the bidding process. It shall be the contractors responsibility to verify these adopted amendments.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

- A. Install domestic water piping system in accordance with ASME B31.9.
- B. Install Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

- A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.
- B. Install sanitary waste and vent piping systems in accordance with Section 22 13 00.
- C. Install bell and spigot pipe with bell end upstream.
- D. Support cast iron drainage piping at every joint.
- E. Install Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with local authority having jurisdiction.
- C. Test sanitary waste and vent piping system in accordance with local authority having jurisdiction.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and disinfect domestic water distribution system in accordance with Section 22 11 00.

END OF SECTION 220503

SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Ball valves.
2. Check valves.
3. Thermal balancing valves.

B. Related Sections:

1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.
4. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping specialties and equipment used in domestic water systems.
5. Section 22 13 00 - Facility Sanitary Sewerage: Product and installation requirements for piping specialties and equipment used in sanitary waste and vent systems.

1.2 REFERENCES**A. American National Standards Institutes:**

1. NSF/ANSI Standard 61 – Low Lead & Lead Free Brass.
2. NSF/ANSI Standard 61, Annex F – Low Lead & Lead Free Brass.
3. NSF/ANSI Standard 61, Annex G – Low Lead & Lead Free Brass.
4. NSF/ANSI Standard 372 – Low Lead & Lead Free Brass.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.****B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.**

- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not install valves underground when bedding is wet or frozen.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two packing kits for each size valve.

1.10 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)

- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 GATE VALVES

- A. Manufacturers:
 - 1. Apollo.
 - 2. Milwaukee.
 - 3. Nibco.
- B. MSS SP-70, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends.
- C. Sizes: 4 inches and larger.
 - 1. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 - Low Lead & Lead Free Brass.

2.2 BALL VALVES

- A. Soldered Connections (2" and Smaller):
 - 1. Manufacturers:
 - a. Apollo model 77CLF240
 - b. NIBCO model S-585-66-LF and model S-585HP-66-LF
 - c. Milwaukee model UPBA450S
 - d. Watts model LFB6081 G2-SS

2. Construction: MSS SP-110, 600 psi, cast bronze body, two piece body, stainless steel ball and stem, full port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle and solder ends.
3. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

B. Soldered Connections (2 ½ to 4”):

1. Manufacturers:
 - a. Apollo model 77CLF240
 - b. NIBCO model S-585-66-LF
 - c. Watts model LFB6081 G2-SS
2. Construction: MSS SP-110, 400 psi, cast bronze body, two piece body, stainless steel ball and stem, full port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle and solder ends.
3. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

C. Press End Connections:

1. Manufacturers:
 - a. Apollo model 77WLF140
 - b. NIBCO model PC-585-66-LF and model PC-585HP-66-LF
 - c. Milwaukee model UPBA400S P2
 - d. Viega model 2971.3 ZL and 2970.3 ZL
2. 2” Inches and Smaller, Construction: MSS SP-110, 200 psi, cast bronze body, two piece body, stainless steel ball and stem, full port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle and press end connections.
3. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

2.3 CHECK VALVES

A. Swing Check Valves (Up to and including 2 inches):

1. Manufacturers:
 - a. Apollo model 161S-LF.
 - b. NIBCO model S-413-Y-LF.
 - c. Milwaukee model UP1509
 - d. Crane model 1340.
2. MSS SP-80, 200 PSI, bronze body and cap, bronze swing disc with renewable seat and disc, solder ends.
3. Check Valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position. Vertical downward flow through check valves is prohibited.
4. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

B. Swing Check Valves (2 ½ inches and larger):**1. Manufacturers:**

- a. Apollo model 910F-LF.
- b. Milwaukee model F-2974-A26
- c. Crane model 373.
- d. Webstone 1054W

2. 2 1/2 Inches and Larger: MSS SP-71, 125 PSI Flanged iron body, epoxy coated, bronze swing disc and trim.
3. Check Valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position. Vertical downward flow through check valves is prohibited.
4. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

C. Spring Check Valves:**1. Manufacturers:**

- a. Apollo Model 61LF-600
- b. NIBCO model S-480-Y-LF
- c. Milwaukee model UP1548T.
- d. Watts model LF601S.

2. Up to and including 2 Inches: MSS SP-139, 250 PSI, bronze body, with PTFE disc, solder ends.
3. Check Valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position. Vertical downward flow through check valves is prohibited.
4. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 - Low Lead & Lead Free Brass.

2.4 THERMAL BALANCING VALVES**A. Manufacturers:**

1. Caleffi Series 1161.
2. Acorn Controls TZV Series.
3. ThermOmegaTech, Inc.
4. Circuit Solver Model CSUAS-CV1.
5. Bell and Gossett Temp Setter TC
6. Kemper Multi-Therm.

- B.** Thermal balancing valve with temperature gauge and check valve for domestic hot water recirculation circuits. Dezincification resistant low-lead brass body. Sizes ½" and ¾" with NPT female connections. Adjustable thermostatic cartridge with EPDM hydraulic seals. Temperature gauge/probe well. Maximum working pressure 200 psi. Maximum differential pressure 15 psi. Adjustment temperature range 95°F to 140°F. Flow rating: 2.1 Cv maximum, 0.23 Cv minimum, 0.52 Cv design. Equipped with: ABS adjustment knob with temperature adjustment scale for manual setting and tamper-proof adjustment locking screw.

- C. Thermal balancing valve is to be set to 120°F unless otherwise noted on drawings.
- D. Valve to be furnished with full port ball valves, integral check valves and union.
- E. Provide manufacturer furnished pre-formed insulation shell for field installation.
- F. Provide manufacturer furnished outlet temperature gauge with 30°F to 180°F.
- G. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.
- F. Refer to Section 22 05 29 for pipe hangers.
- G. Refer to Section 22 07 00 for insulation requirements for valves.
- H. Refer to Section 22 05 03 for piping materials applying to various system types.
- I. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.3 VALVE APPLICATIONS

- A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, branch piping, or vertical risers.
- C. Install ball valves for throttling, bypass, or manual flow control services.

- D. Install ball valves in domestic water systems for shut-off service.
- E. Install thermostatic zone balancing valves at all branch connections to domestic hot water circulating system.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
2. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
3. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
4. Section 07 90 00 - Joint Protection: Product requirements for sealant materials for placement by this section.
5. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
6. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
7. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
8. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, and UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.
- B. Firestopping Materials: ASTM E119, ASTM E814, UL 263, and UL 1479 to achieve fire ratings of adjacent construction in accordance with FM, UL, and Design Numbers.
- C. Surface Burning: ASTM E84 and UL 723 with maximum flame spread / smoke developed rating of 25/450.
- D. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to applicable code FM and UL for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations within Wall Cavities: T-Rating is not required.

- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.
- G. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

- D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.13 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. Creative Systems Inc.
 - 3. Flex-Weld, Inc.
 - 4. Glope Pipe Hanger Products Inc.
 - 5. Michigan Hanger Co.

6. Superior Valve Co.

B. Plumbing Piping:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
7. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:

1. Bolt Products, Inc.
2. Fastenal Fasteners.
3. Atwood Industries.

- B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic refer to Section 07 90 00.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation.
 - 3. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Allied Tube & Conduit Corp.
 - 2. B-Line Systems.
 - 3. Midland Ross Corporation, Electrical Products Division.
 - 4. Unistrut Corp.
 - 5. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Galvanized 12 gage thick steel with holes 1-1/2 inches on center.

2.8 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Fire Trak Corp.
 - 3. Hilti Corp.
 - 4. International Protective Coating Corp.
 - 5. 3M fire Protection Products.
 - 6. Specified Technology, Inc.
 - 7. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Single component foam compound.

3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Sheet metal.
2. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

F. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide sheet lead packing between hanger or support and piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.

- L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.6 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower, and mop sink drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Fire Rated Surface:
 - 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where cable tray, bus, cable bus, conduit, wireway, trough, and penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- E. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
 - 4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 FIELD QUALITY CONTROL

- A. Section 01 14 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

- A. Pipe Hanger Spacing

<u>Pipe Material</u>	Maximum Hanger Spacing <u>Feet</u>	Hanger Rod Diameter <u>Inches</u>
Cast Iron (All sizes)	5	5/8
Cast Iron (All sizes) with 10' length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
PVC (All sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Labels.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Submittal procedures.****B. Product Data: Submit manufacturers catalog literature for each product required.****C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.****D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.****E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.****1.4 CLOSEOUT SUBMITTALS****A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.****B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.****1.5 QUALITY ASSURANCE****A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.**

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.9 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 NAMEPLATES****A. Manufacturers:**

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Substitutions: Not Permitted.

B. Product Description: Laminated three-layer plastic with engraved (see drawings for color) letters on light contrasting background color.**2.2 TAGS****A. Plastic Tags:****1. Manufacturers:**

- a. Craftmark Identification Systems.
- b. Safety Sign Co.
- c. Seton Identification Products.
- d. Substitutions: Not Permitted.

2. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter. See drawings for color.**B. Metal Tags:****1. Manufacturers:**

- a. Craftmark Identification Systems.
- b. Safety Sign Co.
- c. Seton Identification Products.
- d. Substitutions: Not Permitted.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.**2.3 PIPE MARKERS****A. Color and Lettering:** Conform to ASME A13.1.**B. Plastic Pipe Markers:****1. Manufacturers:**

- a. Craftmark Identification Systems.
- b. Safety Sign Co.
- c. Seton Identification Products.
- d. Substitutions: Not Permitted.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:

- a. Craftmark Identification Systems.
- b. Safety Sign Co.
- c. Seton Identification Products.
- d. Substitutions: Not Permitted.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.4 LABELS

A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Substitutions: Not Permitted.

- B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with Section 09 90 00.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow and direction. Install in clear view and align with axis of piping. 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.
- K. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

- A. Identification:
 - 1. See drawings for details.

END OF SECTION 220553

SECTION 220590 - TESTING OF PLUMBING PIPING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Waste and Vent Piping.
2. Domestic Water Piping.

1.2 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.
- N. ARI
- O. ASME
- P. NFPA

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION**3.1 GENERAL**

- A. Before final acceptance of all piping system, all systems must be tested in accordance with the schedule and prove to be free of leaks.
 - 1. Perform tests under observation of Architect/Engineer.
 - 2. Underground systems shall be tested prior to backfilling.
 - 3. Remove, replace or satisfactorily repair defective work revealed by tests.
 - 4. Make piping repairs with new materials; caulking of screwed joints or pin holes is not permitted.
 - 5. Furnish all test equipment and materials for testing.
 - 6. Owner to furnish water for testing and flushing.

3.2 TESTING MATERIAL

- A. Testing Medium:
 - 1. Hydrostatic Testing Medium: Clean Water.
 - 2. Pneumatic Testing Medium: Clean compressed air.
- B. Pressure Testing Gauges: ANSI B40.1, Grade AA; minimum 6 inch diameter dial with scale divisions equal or less than maximum allowable pressure drop.

3.3 TESTING SYSTEMS

- A. Waste and Vent System Piping:
 - 1. Test with water or air before fixtures are set.
 - 2. After plumbing fixtures have been set and traps filled with water, subject entire waste and vent systems to final test with smoke or peppermint.
 - 3. Water Test:
 - a. Apply to drainage and vent system in sections or in entirety dependent on size of system.
 - b. When entire system is tested, tightly close all openings in pipes except highest opening and fill system with water to overflow point.
 - c. When system is tested in sections, tightly plug each opening except highest opening, fill each section with water and test each section with minimum 10 foot head of water; test each preceding section until entire system has been tested with minimum 10 foot head of water, except uppermost 10 feet of system.
 - d. Keep water in system or in portion under test, for minimum 30 minutes before inspection.
 - e. System must be tight at all joints.
 - 4. Air Test:
 - a. When tests are made with air, apply minimum 5 psi with force pump and maintain 1 hour with no leakage apparent.
 - b. Use mercury-column in making test.

B. Domestic Water System:

1. When rough-in is complete and before fixtures are set, test entire hot and cold water piping systems as scheduled and prove tight.
2. Where portion of water piping system is concealed before completion, test that portion separately as specified for entire system.

C. Hydrostatic and Pneumatic Testing Requirements:

1. Hydrostatic and pneumatic tests apply to piping indicated as scheduled in Paragraph D.
2. Pressure to be raised gradually to given value; then block off tight at source.
3. Allowable Pressure Drop: Maximum amount scheduled during corresponding minimum time interval.
 - a. Visually examine all joints during test.
4. Upon successful completion and test approval, relieve piping of pressure, drain, put into normal operation except for potable water to be sterilized before placing in service.

D. Hydrostatic and Pneumatic Testing Schedule:

<u>Service</u>	<u>Normal Work Pressure psig</u>	<u>Hydrostatic Test Pressure psig</u>	<u>Pneumatic Test Pressure psig</u>	<u>Maximum Allowable Pressure Drop psig</u>	<u>Minimum Test Time Hours</u>
1. Domestic Water:					
Potable Water	To 125	175	---	2	2

3.4 CLEANING AND ADJUSTING

A. Cleaning: Thoroughly clean all parts of the piping installation at completion of work.

1. Remove grease, metal cutting and sludge from all equipment, pipes, valves all fittings.
2. Repair all stoppages, discoloration or other damage to finish, furnishings or parts of building that are due to Contractor's failure to properly clean piping system.

B. Adjusting:

1. Adjust flush valves and other parts of work for quiet operation.
2. Adjust control devices for proper operation.
3. Demonstrate to Architect/Engineer satisfactory operation following adjustment.
4. Readjust or replace all items not functioning properly.

END OF SECTION 220590

SECTION 220700 - PLUMBING INSULATION**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:

1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Section 09 90 00 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES**A. ASTM International:**

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
10. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
11. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
12. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
13. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
14. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
15. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

16. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
17. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
18. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
19. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 MANUFACTURER****A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:**

1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

C. Manufacturers for Polyisocyanurate Foam Insulation Products:

1. Dow Chemical Company.

D. Manufacturers for Extruded Polystyrene Insulation Products:

1. Dow Chemical Company.

2.2 PIPE INSULATION**A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.**

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

B. TYPE P-2: ASTM C547, molded glass fiber pipe insulation.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.

2.3 PIPE INSULATION JACKETS**A. Vapor Retarder Jacket:**

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1784, One piece white molded type fitting covers, sheet material, on all pipe fittings, valves, and straight runs.
2. Insulated piping systems concealed above ceilings or in mechanical rooms to have PVC plastic pipe jacketing at fittings.

3. Insulated piping systems exposed (Kitchen Area) to have PVC plastic pipe jacketing at fittings, valves, and straight lengths of pipe.

2.4 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- C. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.

2.5 EQUIPMENT INSULATION

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
 1. Thermal Conductivity: 0.24 at 75 degrees F.
 2. Operating Temperature Range: 0 to 450 degrees F.
 3. Density: 1.5 pound per cubic foot.
- B. TYPE E-8: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
 1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: Range: Minus 70 to 220 degrees F.

2.6 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
 1. Product Description: ASTM D1784, sheet material, off-white color.
 2. Minimum Service Temperature: -40degrees F.
 3. Maximum Service Temperature: 150 degrees F.
 4. Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
 5. Thickness: 20 mil.
 6. Connections: Brush on welding adhesive.

2.7 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping and equipment has been tested before applying insulation materials.

- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations. Piping exposed to view in finished spaces shall have PVC insulated fitting covers on all pipe fittings, flanges, valves and pipe terminations. PVC insulation jacketing on all straight runs of piping. Solvent welding adhesives shall be used to permanently seal all PVC lap joints in the system
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Hot Piping Systems less than 140 degrees F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- E. Hot Piping Systems greater than 140 degrees F:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
 - 3. Insulate flanges and unions at equipment.
- F. Inserts and Shields:
 - 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 - 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

- a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

G. Insulation Terminating Points:

1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

H. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

I. High Temperature Pipe Insulation:

1. Install in multiple layers to meet thickness scheduled.
2. Attach each layer with bands. Secure first layer with bands before installing next layer.
3. Stagger joints between layers.
4. Finish with canvas jacket sized for finish painting.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.3 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
 1. Insulate entire equipment surfaces.
 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 degrees F or Less:
1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment Containing Fluids Over 140 degrees F:
1. Insulate flanges and unions with removable sections and jackets.
 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
 3. Finish insulation at supports, protrusions, and interruptions.
- G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers
- H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- J. Prepare equipment insulation for finish painting. Refer to Section 09 90 00.

3.4 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

<u>Piping System</u>	<u>Insulation Type</u>	<u>Pipe Size</u>	<u>Insulation Thickness Inches</u>
Domestic Hot Water Supply and Recirculation	P-1	All sizes	1.0
Domestic Cold Water	P-1	2" and smaller 2-1/2" and larger	1.0 1.0

B. Drainage Services Piping Insulation Schedule:

<u>Piping System</u>	<u>Insulation Type</u>	<u>Pipe Size</u>	<u>Insulation Thickness Inches</u>
Sanitary Sewer Piping – cast iron, PVC or copper piping receiving chilled water, condensate, water below ambient temperatures (insulate all horizontal suspended	P-1	All sizes	1.0

piping and all vertical piping)

Sanitary Sewer Piping – PVC pipe (insulate all suspended piping and all vertical piping for sound deadening purposes except PVC routed in masonry walls or chases)	P-1	All sizes	1.0

Sanitary Sewer Piping – copper pipe (insulate all suspended piping and all vertical piping_	P-1	All sizes	1.0

Storm Piping & Storm Overflow Piping – cast iron pipe (insulate all horizontal suspended piping and down 1'-0" vertical drop)	P-1	All sizes	1.0

Storm Piping & Storm Overflow Piping – PVC pipe (insulate all horizontal suspended piping and all vertical piping for sound deadening purposes except PVC routed in masonry walls or chases)	P-1	All sizes	1.0

C. Equipment Insulation Schedule:

<u>Equipment</u>	<u>Insulation</u>	<u>Insulation</u>
Roof Drain Bodies	<u>Type</u>	<u>Thickness</u>
	E-8	Inches
		1.0

END OF SECTION 220700

SECTION 221100 - FACILITY WATER DISTRIBUTION**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Pressure gages.
2. Pressure gage taps.
3. Test plugs.
4. Flexible connectors.
5. Strainers.
6. Water hammer arrestors.
7. Hydrants.
8. Thermostatic mixing valves.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
3. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
5. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
6. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
8. Refer to civil drawings for additional information - Soils for Earthwork: Soils for backfill in trenches.
9. Refer to civil drawings for additional information - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Refer to civil drawings for additional information - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Refer to civil drawings for additional information - Trenching: Execution requirements for trenching required by this section.
12. Refer to civil drawings for additional information - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES**A. American National Standards Institute:**

1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.
2. NSF/ANSI Standard 61 – Low Lead & Lead Free Brass.

3. NSF/ANSI Standard 61, Annex F – Low Lead & Lead Free Brass.
4. NSF/ANSI Standard 61, Annex G – Low Lead & Lead Free Brass.
5. NSF/ANSI Standard 372 – Low Lead & Lead Free Brass.

B. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.
2. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
3. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
7. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

D. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.
2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

E. American Water Works Association:

1. AWWA C651 - Disinfecting Water Mains.
2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 - Cold-Water Meters - Compound Type.
5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

F. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

H. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
2. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two loose keys for outside hose bibs.

1.12 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 PRESSURE GAGES****A. Manufacturers:**

1. Ashcroft.
2. Marsh Instrument Co.
3. Marshalltown Instruments, Inc.
4. Taylor.
5. Substitutions: Not Permitted.

B. Gage: ASME B40.1, UL 393 and UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Stainless steel.
2. Bourdon Tube: Brass.
3. Dial Size: 4 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Both psi and kPa.

2.2 PRESSURE GAGE TAPS**A. Manufacturers:**

1. Peterson Equipment Co.
2. Sisco.
3. Trerice.
4. Substitutions: Not Permitted.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.**C. Ball Valve: Brass, 1/8 inch 1/4 inch NPT for 250 psi.****D. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.****E. Siphon: Brass, 1/4 inch NPT angle or straight pattern.****2.3 TEST PLUGS****A. Furnish materials in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.****2.4 FLEXIBLE CONNECTORS****A. Manufacturers:**

1. Milwaukee.
2. Flexicraft.
3. Aeroquip.
4. Hyspan.
5. Substitutions: Not Permitted.

- B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 300 psig.

2.5 STRAINERS

A. Manufacturers:

- 1. Milwaukee.
- 2. Nibco.
- 3. Stockham.
- 4. Apollo.
- 5. Jomar.

- B. 2 1/2 Inches and Smaller: Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

- C. 2 1/2 Inches and Larger: Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

- D. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

2.6 WATER HAMMER ARRESTORS

A. Manufacturers:

- 1. Sioux Chief
- 2. Precision Plumbing Products.
- 3. Watts.

- B. ANSI A112.26.1M; sized in accordance with PDI WH-201, precharged, permanently sealed, suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

- C. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

2.7 WALL HYDRANTS (WH-1)

A. Manufacturers:

- 1. Woodford B67PLL. (Must call manufacturer for Lead Free model specification sheet).
- 2. Mifab.
- 3. Zurn.
- 4. J.R. Smith.
- 5. Watts.

- B. ANSI/ASSE 1019; Lead Free, non-freeze, self-draining type with cast stainless steel lockable recessed box hose thread spout, lockshield and removable key, and integral self-draining vacuum breaker.

- C. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

2.8 THERMOSTATIC MIXING VALVES**A. Thermostatic Mixing Valve – Point of Use Mixing Valve (TMV-1):****1. Manufacturers:**

- a. Symmons, Model: 8210CK.
- b. Watts.
- c. Lawler.
- d. Bradley.
- e. Powers.
- f. Leonard.

- 2. ASSE 1070/1017 and ASME A112.18.1 certified, solid brass body, integral spring checks, stainless steel debris strainer, 3/8" compression ports, temperature control range of 59F-115F degrees, vandal-resistant cap, mounting bracket included and 10-Year Commercial Warranty.
- 3. NSF/ANSI Standard 61, NSF 61, Annex F, NSF 61 Annex G and NSF 372 - Low Lead and Lead Free Brass.

B. Thermostatic Mixing Valve - Boys & Girls Shower (TMV-2):**1. Manufacturers:**

- a. Leonard, Model XL-186-690-LF-STSTL REC.
- b. Lawler.
- c. Bradley.
- d. Powers.

- 2. ASSE 1070; rough bronze finish, locking temperature regulator, integral temperature adjustment and integral check valves on inlets.
- 3. Valve: ASSE 1017; chrome plated finish, locking temperature regulator, 1" inlets, 1 1/4" outlet, integral temperature adjustment minimum flow 0.5 GPM, rated flow 20 GPM at 15 PSI drop.
- 4. Accessories:
 - a. Integral combination check stops with strainer on inlets.
 - b. Dial thermometer on outlet.
 - c. Ball valve with dial thermometer on outlet.
- 5. NSF/ANSI Standard 61, NSF 61, Annex F, NSF 61 Annex G and NSF 372 - Low Lead and Lead Free Brass.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - THERMOMETERS AND GAGES

- A. Install gage taps in piping.
- B. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
- D. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- E. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- F. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- G. Install Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Provide flow controls in water circulating systems as indicated on Drawings.
- B. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- C. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- D. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping.
- E. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.
- F. Install Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Test domestic water piping system in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

3.6 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- E. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 221100

SECTION 221300 - FACILITY SANITARY SEWERAGE**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Floor drains.
2. Floor sinks.
3. Trench drains.
4. Cleanouts.
5. Air gap fittings.
6. Trap Sealer.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
3. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
5. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
6. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
8. Section 31 05 13 - Soils for Earthwork: Soils for backfill in trenches.
9. Section 31 05 16 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
11. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
12. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME A112.14.3 - Grease Interceptors.
2. ASME A112.14.4 - Grease Removal Devices.
3. ASME A112.21.1 - Floor Drains.
4. ASME B31.9 - Building Services Piping.

B. Plumbing and Drainage Institute:

1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit pipe fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
 - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 - 2. Piping layout.
 - 3. Penetrations through fire rated and other walls.
 - 4. Plumbing equipment.
 - 5. Hangers and supports, including methods for building attachment, and vibration isolation.
- C. Product Data:
 - 1. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
 - 2. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of equipment and clean-outs.
- C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with sewage ejector service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two sets of pump seals.

1.12 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)

- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Floor Drain (FD-1):

1. Manufacturers:

- a. Mifab, Model F1000-C-3.
- b. Zurn.
- c. J.R. Smith.
- d. Josam.
- e. Watts.
- f. Wade.

2. ANSI A112.21.1; lacquered, cast iron two piece body with anchor flange, weep holes, and heavy duty, polished round stainless steel strainer with stainless steel vandal proof allen key screws.

2.2 FLOOR SINKS

A. Square Floor Sinks (FS-2):

1. Manufacturers:

- a. Mifab, Model FS1740-FL-150-3 (12" x 12" x 10").
- b. Zurn.
- c. J.R. Smith.
- d. Josam.
- e. Watts.
- f. Wade.

2. ANSI A112.21.1; cast iron flanged 12" square receptor with seepage holes, acid resistant coated interior, stainless steel frame and secured square half grate. Aluminum dome bottom strainer.

2.3 TRENCH DRAINS

A. Trench Drain (TD-1):

1. Manufacturers:

- a. Zurn, Model Z880.
- b. Mifab.
- c. J.R. Smith.
- d. Josam.
- e. Watts.
- f. Wade.

2. High density polyethylene channels of interlocking design, radius bottom, 2-1/2" wide top grate opening with 1-3/4" wide interior dimension. Trench drain system to be complete with necessary end caps, bottom outlet connection and polyethylene decorative grate. Grate color to be selected by architect.
3. Install per manufacturers recommendations. Minimum 4" concrete on both sides and underneath channels. Protect grates and channel interior during pouring of concrete. Place concrete in a manner that will not dislodge the channels.

2.4 CLEANOUTS

A. Floor Cleanout (FCO-1):

1. Manufacturers:
 - a. Mifab, Model C1220.
 - b. Zurn.
 - c. J.R. Smith.
 - d. Josam.
 - e. Watts.
 - f. Wade.
2. Interior Finished Floor Areas (FCO-1): Lacquered cast iron, two piece body with double drainage flange, and heavy duty cast stainless steel scoriated combined cover/plug top assembly with stainless steel vandal proof allen key screws and primary gasket seal.
3. Provide stainless steel square top in areas with quarry tile or ceramic tile.
4. Provide secondary closure plug.

B. Wall Cleanouts (WCO):

1. Manufacturers:
 - a. Mifab, Model C1460-RD.
 - b. Zurn.
 - c. J.R. Smith.
 - d. Josam.
 - e. Watts.
 - f. Wade.
2. Interior Finished Wall Areas: Line type with lacquered cast iron body and round brass gasketed plug and round stainless steel access cover secured with machine screw.

2.5 AIR GAP FITTINGS (AGF-1)

A. Manufacturers:

1. Mifab, Model MI-CAG-T-30NH.
2. Zurn.
3. J.R. Smith.
4. Josam.
5. Watts.
6. Wade.

- B. Fixed air gap fixture with set screw and threaded outlet.

2.6 TRAP SEALER (TS-1)

- A. Manufacturers:

- 1. Sure Seal, Model SS4009.

- B. ASSE-1072 AF-GW; Trap seal shall be Sure Seal preassembled inline floor drain trap sealer. 2 pieces: 1 commercial grade abs plastic housing & proprietary neoprene rubber diaphragm with 1 soft rubber sealing gaskets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Remove scale and dirt, on inside and outside, before assembly.
- B. Prepare piping connections to equipment with flanges or unions.
- C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Install floor cleanouts at elevation to accommodate finished floor or grade.
- D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, flush valves, interior and exterior hose bibs.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

END OF SECTION 221300

SECTION 224000 - PLUMBING FIXTURES**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Water closets.
2. Urinals.
3. Lavatory.
4. Wash fountains.
5. Mop basins.
6. Electric water coolers.
7. Shower.
8. Lavatory Faucet.
9. Whirlpool faucet.

B. Related Sections:

1. Section 07 90 00 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
3. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES**A. American National Standards Institute:**

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers:

1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.
3. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
4. ASME A112.19.3 - Stainless Steel Plumbing Fixtures.
5. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
6. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

- B. Product Data: Submit catalog illustrations of fixtures, sizes, [rough-in dimensions,] utility sizes, trim, and finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.
- B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Supply 1 set of faucet repair kit of each type specified.

1.10 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)

- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 FLUSH VALVE HANDICAP WATER CLOSETS (HWC-1)

- A. Bowl:
 - 1. Manufacturer:
 - a. Kohler, Model K-4325.
 - b. American Standard.
 - 2. ASME A112.19.2; wall hung, siphon jet, 1.6 gallon flush, white vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud.
- B. Exposed Flush Valve:
 - 1. Manufacturer:
 - a. Sloan, Model Royal G2 Optima Plus 8111-1.6.
 - 2. ASME A112.18; exposed chrome plated, 1-1/2 top spud, battery powered, top mounted sensor operated, 1.6 gallon flush, escutcheon, integral screwdriver stop and vacuum breaker.
- C. Seat:
 - 1. Manufacturer:
 - a. Bemis, Model 2155-SSC.
 - b. Church.

- c. Olsonite.
 - 2. Solid black plastic, open front, extended back, self-sustaining hinge, stainless steel posts and anti-microbial agent.
- D. Wall Mounted Carrier:
- 1. Manufacturer:
 - a. Wade.
 - b. J.R. Smith.
 - c. Zurn.
 - 2. ASME A112.6.1: Commercial closet carrier, iron frame, lugs for wall attachment, threaded fixture studs with nuts and washers.
- E. Mounting Height: Fixture mounted at ADA compliant height. Refer to architectural drawings for exact height.
- 2.2 FLUSH VALVE WATER CLOSETS (WC-1)
- A. Bowl:
- 1. Manufacturer:
 - a. Kohler, Model K-4325.
 - b. American Standard.
 - 2. ASME A112.19.2; wall hung, siphon jet, 1.6 gallon flush, white vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud.
- B. Exposed Flush Valve:
- 1. Manufacturer:
 - a. Sloan, Model Royal G2 Optima Plus 8111-1.6.
 - 2. ASME A112.18; exposed chrome plated, 1-1/2 top spud, battery powered, top mounted sensor operated, 1.6 gallon flush, escutcheon, integral screwdriver stop and vacuum breaker.
- C. Seat:
- 1. Manufacturer:
 - a. Bemis, Model 2155-SSC.
 - b. Church.
 - c. Olsonite.
 - 2. Solid black plastic, open front, extended back, self-sustaining hinge, stainless steel posts and anti-microbial agent.

D. Wall Mounted Carrier:**1. Manufacturer:**

- a. Wade.
- b. J.R. Smith.
- c. Zurn.

2. ASME A112.6.1: Commercial closet carrier, iron frame, lugs for wall attachment, threaded fixture studs with nuts and washers.**E. Mounting Height: Fixture mounted at standard height. Refer to architectural drawings for exact height.****2.3 WALL HUNG HANDICAP URINAL (HU-1)****A. Urinal:****1. Manufacturer:**

- a. Kohler, Model K-4972-T.
- b. American Standard.
- c. Zurn.

2. ASME A112.19.2; vitreous china, wall hung blow-out urinal, 1.0 gallon flush, integral trap, and 1 1/4 inch top spud.**B. Exposed Flush Valve:****1. Manufacturer:**

- a. Sloan, Model Royal G2 Optima Plus 8180-1.0.

2. ASME A112.18.1; exposed chrome plated, 1 1/4" top spud, battery back-up powered, sensor operated, 1.0 gallon flush, escutcheon, integral screwdriver stop, vandal resistant stop cap, and vacuum breaker.**C. Wall Mounted Carrier:****1. Manufacturer:**

- a. Wade.
- b. J.R. Smith.
- c. Zurn.

2. ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, and bearing studs.**D. Mounting Height: Fixture mounted at ADA compliant height. Refer to architectural drawings for exact height.**

2.4 WALL HUNG URINAL (U-1)**A. Urinal:****1. Manufacturer:**

- a. Kohler, Model K-4972-T.
- b. American Standard.
- c. Zurn.

- 2. ASME A112.19.2; vitreous china, wall hung blow-out urinal, 1.0 gallon flush, integral trap, and 1 1/4 inch top spud.

B. Exposed Flush Valve:**1. Manufacturer:**

- a. Sloan, Model Royal G2 Optima Plus 8180-1.0.
- 2. ASME A112.18.1; exposed chrome plated, 1 1/4" top spud, battery back-up powered, sensor operated, 1.0 gallon flush, escutcheon, integral screwdriver stop, and vacuum breaker.

C. Wall Mounted Carrier:**1. Manufacturer:**

- a. Wade.
- b. J.R. Smith.
- c. Zurn.
- 2. ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, and bearing studs.

D. Mounting Height: Fixture mounted at standard height. Refer to architectural drawings for exact height.**2.5 HANDICAP LAVATORIES (HL-1)****A. Vitreous China Wall Hung Basin:****1. Manufacturer:**

- a. American Standard Model Lucerene 0356.015.
- b. Kohler.
- c. Zurn.
- 2. ASME A112.19.2; white vitreous china, wall hung lavatory 21 x 18 inch minimum, with 5 inch high back, drillings on 8 inch centers, rectangular basin with splash lip, and front overflow.

B. Supply Fitting:**1. Manufacturer:**

- a. Chicago Faucet Model 404-203387AB.
- b. Zurn.
- c.

2. ASME A112.18.1; deck mounted chrome plated brass supply with 8" centers, base: 404, quarter turn wrist blade handles: 317-PRVPJKCP, cartridge: 377-XTAB, 5" spout: 404, Outlet: E66VPJKABCP.

C. Accessories:

1. Chrome plated 17 gage brass P-trap with cleanout plug and arm with escutcheon.
2. Chrome plated 17 gage brass overflow plug waste connection with perforated open grid strainer.
3. ADA offset waste.
4. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.
5. Supply Stops: Loose Key, Chrome-plated brass, commercial pattern, one-quarter-turn, ball-type valve with inlet connection matching supply piping. Supply stop valve shall be certified by recognized testing agency and bear manufacturing and testing mark.
6. Chrome plated rigid supplies.
7. Insulate drain piping, angle stops, and supply piping with Truebro Lav Guard2 insulation kit or approved equal.
8. ASSE 1070 point-of-use thermostatic mixing valve (TMV-1) mounted under lavatory. Refer to Specification Section 22 11 00.

D. Wall Mounted Carrier:**1. Manufacturer:**

- a. Mifab.
- b. Zurn.
- c. J.R. Smith.
- d. Watts.

2. ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, and bearing studs.

E. Mounting Height: Fixture mounted at ADA compliant height. Refer to architectural drawings for exact height.**2.6 LAVATORY SYSTEM (LS-1) THREE PERSON STATION****A. Manufacturer:**

1. Sloan Stone Lavatory System, (Model ELS-73650).

B. Bowl shall be a cast polyester resin complying with ANSI Z124.6. Panels and bowl shall be secured to a 16-gauge type 304 stainless steel accented with 18 gauge brushed stainless steel front panels and support frame mounted to wall. Lavatories shall comply

with ANSI and ADA accessibility standards. Lavatory system shall have Sloan faucet EBF-650 and hole pattern for this faucet.

C. Color by Architect.

D. Accessories:

1. Chrome plated 17 gage brass P-trap with cleanout plug and arm with escutcheon.
2. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.
3. Supply Stops: Loose Key, Chrome-plated brass, commercial pattern, one-quarter-turn, ball-type valve with inlet connection matching supply piping. Supply stop valve shall be certified by recognized testing agency and bear manufacturing and testing mark.
4. Chrome plated rigid supplies.
5. ASSE 1070 point-of-use thermostatic mixing valve (TMV-1) mounted under lavatory. Refer to Specification Section 22 11 00.

2.7 MOP BASIN

A. Mop Basin (MB-1):

1. Manufacturers:
 - a. Fiat Model TSB3012.
 - b. Acorn.
 - c. Florestone.
 - d. Creative Industries Terrazzo Products, Inc.
2. One piece precast Terrazzo Mop Basin. 36" x 36" x 12" high sides with 6" drop front, stainless steel threshold, removable stainless steel strainer, and stainless steel wall guards.

B. Trim:

1. Manufacturer:
 - a. Chicago Faucet Model 897-CCP.
2. ASME A112.18.1 exposed wall type supply with 369 handles, spout wall brace, vacuum breaker, hose end spout, integral stops, integral checks and escutcheon plates.

2.8 ELECTRIC WATER COOLER (EWC-1)

A. Fountain:

1. Manufacturer:
 - a. Elkay Model LZSTL8WSLK.
2. ARI 1010; Two level wall mounted stainless steel electric water cooler, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket, refrigerated with integral air cooled condenser. Lower unit on right when facing dual height electric water coolers. Push button on front. Unit to

have complete filtered cooler and bottle filling station, no-touch, sensor activated with 30 second shut-off timer, mounted directly top of electric water cooler. Bottle fill station on higher electric water cooler.

- a. Capacity: 8.0 gpm of 50 degree F. water with inlet at 80 degree F. and room temperature of 90 degree F.
- b. Electrical: Maximum 1/5 HP compressor, 2 foot cord and plug for connection to electric wiring system including grounding connector.
- c. Stainless steel lower shroud on each unit.
- d. Water sentry plus filter.

B. Accessories:

1. Chrome plated 17 gage brass P-trap with cleanout plug and arm with escutcheon.
2. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.
3. Supply Stops: Loose Key, Chrome-plated brass, commercial pattern, one-quarter-turn, ball-type valve with inlet connection matching supply piping. Supply stop valve shall be certified by recognized testing agency and bear manufacturing and testing mark.
4. Chrome plated rigid supplies.
5. Provide cane apron option as needed. Contractor to verify with architect if required.

2.9 SHOWER – Boys & Girls Locker Shower (SH-1)

A. Manufacturer:

1. Bradley Model Coverall WS-1WCA-AST-SHV-RSD.

- B. Shower Panel: Type 304, stainless steel, 18 gauge, #4 polish finish with stainless steel soap tray mounted to panel. Vertical shroud extend to above finished ceiling.
- C. Shower Valve: Air metering valve, forged brass body, stainless steel push button, in-line strainer, nickel plated timer.
- D. Shower Head: Standard fixed direction adjustable spray.
- E. Recessed Soap Dish.
- F. Provide stainless steel angle collar at ceiling.

2.10 HANDICAP SHOWER - Boys & Girls Locker Shower (HSH-1)

A. Manufacturer:

1. Bradley Model Coverall WS-1WCA-ADA-AST-SHV-RSD.

- B. ADA compliant.
- C. Shower Panel: Type 304, stainless steel, 18 gauge, #4 polish finish with stainless steel soap tray mounted to panel. Vertical shroud extend to above finished ceiling.
- D. Shower Valve: Air metering valve, forged brass body, stainless steel push button, in-line strainer, nickel plated timer.

E. Shower Head: Standard fixed direction adjustable spray.

F. Recessed Soap Dish.

G. Provide stainless steel angle collar at ceiling.

2.11 HANDICAP SHOWER - Staff Toilet Shower (HSH-2)

A. Manufacturer:

1. Bradley Model Coverall 1WCA-ADA-SVL-SHV-RSD.

B. ADA compliant.

C. Shower Panel: Type 304, stainless steel, 18 gauge, #4 polish finish with stainless steel soap tray mounted to panel. Vertical shroud extend to above finished ceiling.

D. Shower Valve: Single compression with lever handle, forged brass body, in-line strainer.

E. Shower Head: Standard fixed direction adjustable spray.

F. Recessed Soap Dish.

G. Provide stainless steel angle collar at ceiling.

2.12 LAVATORY FAUCET (LF-1)

A. Manufacturer:

1. Moen Commercial Model: 8278SMF15.

2. ASME A112.18.1; chrome plated brass supply with low-rise rigid spout, ceramic 1/4-turn cartridges, water economy 1.5 GPM aerator, 4" ADA wrist blade handles and 4" centers.

B. Accessories:

1. Chrome plated 17 gage brass P-trap with cleanout plug and arm with escutcheon.

2. Chrome plated 17 gage brass overflow plug waste connection with perforated open grid strain.

3. ADA offset waste.

4. NSF/ANSI Standard 61, NSF 61 Annex F, NSF 61 Annex G & NSF 372 – Low Lead & Lead Free Brass.

5. Supply Stops: Loose Key, Chrome-plated brass, commercial pattern, one-quarter-turn, ball-type valve with inlet connection matching supply piping. Supply stop valve shall be certified by recognized testing agency and bear manufacturing and testing mark.

6. Chrome plated rigid supplies.

7. For ADA locations insulate drain piping, angle stops, and supply piping with Truebro Lav Guard2 insulation kit or approved equal.

8. ASSE 1070 point-of-use thermostatic mixing valve (TMV-1) mounted under lavatory. Refer to Specification Section 22 11 00.

2.13 WHIRLPOOL FAUCET (WF-1)

- A. Manufacturer:
 - 1. Whitehall Model: MXT15-OTG.
- B. MXT15-OTG is a chrome-plated, lead-free brass thermostatic mixing valve that can deliver tempered water from 0.5 to 15 gallons (1.9 to 57 liters) per minute and is recommended for use with Whitehall Whirlpools. The valve is compliant to ASSE 1070, ASSE 1069 and is CSA B125.3 listed.
- C. Provide stainless steel braided flexible hose and whirlpool filler spout bracket.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify electric power is available and of correct characteristics.
- D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Perform Work in accordance with Illinois Department of Public Health Plumbing Code, Current Edition and local jurisdiction amendments to Plumbing Code.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid to fixtures with loose key stops and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with floor secured carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 00, color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

- A. Fixture Rough-In:

<u>Fixture</u>	<u>Hot Inches</u>	<u>Cold Inches</u>	<u>Waste Inches</u>	<u>Vent Inches</u>
Water Closet (Flush Valve):		1	4	2
Urinal (Flush Valve):		3/4	2	1-1/2
Wash Fountains:	1/2	1/2	1-1/2	1-1/4
Mop Basin:	1/2	1/2	3	1-1/2
Electric Water Cooler:		1/2	1-1/4	1-1/4
Shower:	1/2	1/2	4	2
Whirlpool Faucet:	1/2	1/2		

END OF SECTION 224000

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel.
7. Firestopping relating to HVAC work.
8. Firestopping accessories.
9. Equipment bases and supports.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, ASTM E814, UL 263 or UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
- B. Surface Burning: ASTM E84 or UL 723 with maximum flame spread / smoke developed rating of 25/450.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

1.13 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)

- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

- 1. Unistrut.
- 2. Grinnell.
- 3. B-Line.

B. Hydronic Piping:

- 1. Conform to ASME B31.9.
- 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch Malleable iron or Carbon steel, adjustable swivel, split ring.
- 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- 4. Hangers for Hot Pipe Sizes 2 to 4 inches Carbon steel, adjustable, clevis.
- 5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
- 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
- 8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- 9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
- 10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
- 11. Vertical Support: Steel riser clamp.
- 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 13. Floor Support for Hot Pipe Sizes 4 Inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- 14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- 15. Copper Pipe Support: Copper-plated, carbon steel ring.

C. Refrigerant Piping:

- 1. Conform to ASME B31.5.
- 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
- 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 HANGER RODS

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 1. Thunderline Link-Seal, Inc.
 2. NMP Corporation.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FORMED STEEL CHANNEL

- A. Manufacturers:
 1. Allied Tube & Conduit Corp.
 2. B-Line Systems.
 3. Midland Ross Corporation, Electrical Products Division.
 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage thick steel minimum with holes 1-1/2 inches on center.

2.7 FIRESTOPPING**A. Manufacturers:**

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single or Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.**2.8 FIRESTOPPING ACCESSORIES****A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.****B. Dam Material: Permanent:**

1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.**D. General:**

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect before using powder-actuated anchors.
- E. Do not drill or cut structural members.
- F. Obtain permission from Architect and Structural Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1.
- B. Support horizontal piping as scheduled.

- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support vertical piping at every floor.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

3.6 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place intumescent coating in sufficient coats to achieve rating required.

- F. Remove dam material after firestopping material has cured.
- G. Fire Rated Surface:
 - 1. Seal opening at floor, wall, partition, and ceiling as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- H. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition floor, and ceiling roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
 - 4. Interior partitions: Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.7 FIELD QUALITY CONTROL

- A. Section 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

Pipe Size Inches	Copper Tub- ing Maximum Hanger Spac- ing Feet	Steel Pipe Maximum Hanger Spac- ing Feet	Copper Tub- ing Hanger Rod Diameter Inches	Steel Pipe Hanger Rod Diameter Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	9	11	1/2	1/2
3	10	12	1/2	1/2
4	12	14	1/2	5/8
5	13	16	1/2	5/8
6	14	17	5/8	3/4
8	16	19	3/4	3/4
10	18	22	3/4	7/8
12	19	23	3/4	7/8

B. Plastic and Ductile Iron Pipe Hanger Spacing:

Pipe Material	Maximum Hanger Spacing Feet	Hanger Rod Diameter Inches
ABS (All sizes)	4	3/8
FRP (All Sizes)	4	3/8
Ductile Iron (Note 1)		
PVC (All Sizes)	4	3/8

- C. Note 1: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROLS FOR HVAC EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Vibration Isolation Curb.

B. Related Sections:

1. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Product requirements for anchors and piping expansion compensation.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
3. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
4. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 REFERENCES**A. Air Movement and Control Association International, Inc.:**

1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:

1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

D. American Society of Heating, Refrigerating and:

1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
2. ASHRAE Handbook - HVAC Applications.

E. ASTM International:

1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.

F. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.
- D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.
- E. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.
- F. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.
- G. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.
- H. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of hangers including attachment points.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA 300, ANSI S1.13 standards and recommendations of ASHRAE 68.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 VIBRATION ISOLATING ROOF CURBS**

- A. Manufacturers:

- 1. Thybar.
 - 2. Pate.
 - 3. Mason Industries.

- B. General Description:

- 1. The roof curbs shall be factory fabricated fully insulated, including the isolator area, weatherproof roof curbs with vibration isolators.
 - 2. The base shall be designed so that it can be re-roofed without disturbing the rooftop unit.

3. The vibration eliminating portion of the curb assembly shall be constructed of structural steel and designed to match the bottom of the rooftop unit. The vibration isolators shall provide a minimum isolation, efficiency of 90% with 2" deflection.
4. The roof curb shall be supplied complete with wood nailing strip and continuous 9" rubber counter flashing for watertight construction.
5. **The base of the curb shall have solid bottom with openings for the rooftop supply and return connection.**
6. **The contractor shall field install (2) layers of 5/8" gypsum board on top of deck, 12" thick sound batt insulation, (1) layer of 5/8" gypsum board, and sound batt insulation to the top of the curb. See the detail on the drawings.**
7. Curbs shall match the pitch of the roof.
8. Curbs (below isolators) shall be minimum of 24" high, above the surface of the roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 INSTALLATION

- A. Support duct silencers independent of ductwork with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet.
- B. Lag ductwork, where indicated by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.
- C. Install isolation for motor driven equipment.
- D. Adjust equipment level.
- E. Install spring hangers without binding.
- F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- H. Support piping connections to isolated equipment resiliently as follows:
 1. Up to 4 inch Diameter: First three points of support.
 2. 5 to 8 inch Diameter: First four points of support.
 3. 10 inch Diameter and Over: First six points of support.
 4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.
- I. Support duct silencers rigidly to ductwork.

3.3 FIELD QUALITY CONTROL

- A. Inspect isolated equipment after installation and submit report. Include static deflections.
- B. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.
- C. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Labels.

1.2 REFERENCES**A. American Society of Mechanical Engineers:**

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 NAMEPLATES**

- A. Manufacturers:
 - 1. Craftmark Identification Systems.
 - 2. Safety Sign Co.
 - 3. Seton Identification Products.
- B. Product Description: Laminated three-layer plastic with engraved (see drawings for color) letters on light contrasting background color.

2.2 TAGS**A. Plastic Tags:**

1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
2. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter. See drawings for color.

B. Metal Tags:

1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

2.3 PIPE MARKERS**A. Color and Lettering: Conform to ASME A13.1.****B. Plastic Pipe Markers:**

1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

2.4 LABELS**A. Manufacturers:**

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.

B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. In addition to providing engraved plastic name plates on the RTUs and CUHs provide engraved plastic name plates.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow and direction. Install in clear view and align with axis of piping. 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.

3.3 SCHEDULES

- A. Identification:
 - 1. See drawings for details.
- B. Contractor shall provide an 8-1/2 x 11 valve chart and schedule in aluminum frame with clear plastic shield. Install at location directed by owner.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Testing, adjusting, and balancing of air systems.
2. Testing, adjusting, and balancing of hydronic and refrigerating systems.
3. Measurement of final operating condition of HVAC systems.

B. Related Sections:

1. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES**A. Associated Air Balance Council:**

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Submittal procedures.****B. Prior to commencing Work, submit proof of latest calibration date of each instrument.****C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms containing information indicated in Schedules.****D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.****E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.****F. Submit draft copies of report for review prior to final acceptance of Project.**

- G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111, NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. Maintain one copy of each document on site.
- C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.6 SEQUENCING

- A. Section 01 10 00 - Summary: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.7 SCHEDULING

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Schedule and provide assistance in final adjustment and test of life safety and smoke evacuation system with Fire Authority.

1.8 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)

- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Service and balancing valves are open.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

3.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

- 1. Air Inlets and Outlets.
- 2. Rooftop Units.

B. Report Forms

1. Title Page:

- a. Name of Testing, Adjusting, and Balancing Agency
- b. Address of Testing, Adjusting, and Balancing Agency
- c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
- d. Project name
- e. Project location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project altitude
- j. Report date

2. Summary Comments:

- a. Design versus final performance
- b. Notable characteristics of system
- c. Description of systems operation sequence
- d. Summary of outdoor and exhaust flows to indicate building pressurization
- e. Nomenclature used throughout report
- f. Test conditions

3. Instrument List:

- a. Instrument
- b. Manufacturer
- c. Model number
- d. Serial number
- e. Range
- f. Calibration date

4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
5. Terminal Unit Data:
 - a. Manufacturer
 - b. Type, constant, variable, single, dual duct
 - c. Identification/number
 - d. Location
 - e. Model number
 - f. Size
 - g. Minimum static pressure
 - h. Minimum design air flow
 - i. Maximum design air flow
 - j. Maximum actual air flow
 - k. Inlet static pressure
6. Heating Coil Data:
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Entering air temperature, design and actual
 - g. Leaving air temperature, design and actual
 - h. Air pressure drop, design and actual
7. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM

8. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
 - j. Percent of design air flow
9. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature
 - k. Actual mixed air temperature
 - l. Design outside/return air ratio
 - m. Actual outside/return air ratio
10. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. HVAC piping insulation, jackets and accessories.
2. HVAC ductwork insulation, jackets, and accessories.

1.2 REFERENCES**A. ASTM International:**

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
6. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
7. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
8. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
9. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
10. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
11. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
12. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
13. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
14. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
15. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
16. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

20. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
2. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Field Applied Grease Duct Fire Rated Enclosure: Provide ICC-ES ESR report.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 PIPING INSULATION****A. TYPE P1: Glass Fiber.****1. Manufacturers:**

- a. Owens Corning Fiberglass.
- b. Knauf.
- c. Certainteed Corp.
- d. Mansville.
- e. Armstrong.

2. Insulation: ASTM C547; rigid molded, noncombustible.

- a. 'K' Value: ASTM C335, 0.24 at 75 degrees F.
- b. Minimum Service Temperature: 0 degrees F.
- c. Maximum Service Temperature: 250 degrees F.
- d. Maximum Moisture Absorption: 0.2 percent by volume.

3. Vapor Barrier Jacket:

- a. ASTM C921, white kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
- b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
- c. Secure with self-sealing longitudinal laps and butt strips.
- d. Secure with outward clinch expanding staples and vapor barrier mastic.

4. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch center.**5. Vapor Barrier Lap Adhesive:**

- a. Compatible with insulation.

6. Insulating Cement/Mastic:**a. Manufacturers:**

- 1) Fibrex.
- 2) Dabco.

- b. ASTM C195; hydraulic setting on mineral wool.

B. TYPE P-2: EPDM Elastomeric Cellular Insulation.**1. Acceptable Manufacturers:**

- a. Aeroflex/Aerocel.
- b. Armacell.
- c. K-Flex/Echo.

2. Insulation:

- a. Insulation material shall be an EPDM rubber, flexible, closed-cell elastomeric insulation in tubular form. The product will be tested for and meet or exceed the requirements defined in ASTM C534.
- b. EPDM elastomeric insulation material shall be manufactured without the use of CFC's, HFC's or HCFC's.
- c. EPDM elastomeric insulation shall have a flame-spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84, for all products through 2" thickness. Product to be suitable for use from -297°F to 257°F continuous service temperature, per ASTM C411.
- d. EPDM elastomeric insulation shall have a maximum thermal conductivity of 0.245 Btu-in./h/ft²-°F at a 75°F mean temperature when tested in accordance with ASTM C177 or ASTM C518.
- e. EPDM elastomeric insulation shall have a maximum water vapor transmission of 0.03 perm-inches when tested in accordance with ASTM E96, Procedure A, latest revision.
- f. Product must exhibit long-term UV resistance, when unfinished in outdoor installations, per ASTM G7 and ASTM G90.
- g. EPDM elastomeric insulation must not contribute to external stress corrosion cracking as when tested by ASTM C692.
- h. Longitudinal joints shall have factory applied lap tape.
- i. OFF-WHITE COLOR WHEN USED FOR HOT-CHILLED WATER.
- j. STANDARD BLACK COLOR WHEN USED FOR REFRIGERANT PIPING.

3. Adhesives, Tapes, and Finishes:

- a. Adhesives shall be the insulation manufacturer's recommended contact adhesive: Aerocel AeroSeal or approved equal.
- b. Seaming tape to be 15-mil EPDM rubber with acrylic adhesive: Aerocel Protape or approved equal. Longitudinal seam closure is to be Stay-Seal with Protape and butting sections are to be glued with AeroSeal adhesive (or approved equal adhesives). Closures must provide water and water vapor tight seal when tested in accordance with ASTM D 3816. VOC content must be no more than 1.3% when tested in accordance with ASTM D 3960. Closures must be capable of being sealed at a low temperature of 0°F. Closures must be kept free of dust, dirt, moisture, lubricants and other contaminants.
- c. Elbows, "P" traps, and Tees with mitered insulation fittings using tubular EPDM flexible elastomeric insulation sections, color matched to pipe insulation.
- d. Accessories such as adhesives, mastics and cements shall not detract from any of the system ratings as specified above.

4. Insulated Pipe Saddles:

- a. Insulated pipe saddles will be high-density insulation with an inner lining of EPDM rubber insulating tape and an EPDM rubber exterior or jacket.
- b. Density of insulation is to be a minimum of 10 lbs./cu/ ft., with a compressive strength of 284 P.S.I. or greater, and a k-value of .312 or lower, usage temperature range of -297°F to 257°F, water absorption of 5% or less. Exterior jacket is to be 15-mil thick EPDM rubber.

5. Factory Fabricated Insulating Fitting Covers: Insulating fitting covers for 90 degree elbows, tee's, and 45 degree elbows, and mechanical grooved fittings will be factory-fabricated insulating fitting covers. The insulating fitting covers are to be made of EPDM rubber, with insulation thickness to match material on straight run piping. Color shall match the straight pipe insulation. Aeroflex USA Aerofit insulating fitting covers (or equal).

2.2 JACKETS

- A. Jacket: Ventureclad insulation jacketing tape-1579CW.
 1. Minimum Service Temperature: -40 degrees F.
 2. Maximum Service Temperature: 248 degrees F.
 3. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches.
 4. Maximum Flame Spread: ASTM E84; 25.
 5. Maximum Smoke Developed: ASTM E84; 50.
 6. Tape joints with 1577CW-E tape.
 7. Stucco embossed.

2.3 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C553, flexible, noncombustible blanket.
 1. 'K' Value: ASTM C518, 0.29 at 75 degrees.
 2. Maximum moisture absorption: 0.20 percent by volume.
- B. TYPE D-2: ASTM C612, rigid, noncombustible fiberglass duct board.
 1. 'K' Value: ASTM C518, 0.29 at 75 degrees.
 2. Maximum moisture absorption: 0.20 percent by volume.
 3. Density: 3 lb/cu ft.
 4. Thickness: 2".
- C. TYPE D-3: ASTM C553, flexible, noncombustible fiberglass duct liner.
 1. 'K' Value: ASTM C518, 0.29 at 75 degrees.
 2. Density: 1.5 lb/cu ft.
 3. Maximum velocity on coated air side: 4,000 ft/min.
- D. TYPE D-4: ASTM C534, Type I, flexible, closed cell elastomeric insulation sheet.
 1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: Minus 70 to 180 degrees F.

2.4 DUCTWORK INSULATION JACKETS

- A. Vapor Retarder Jacket:
 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
 3. Secure with pressure sensitive tape.
- B. Canvas Duct Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

- C. Outdoor Duct Jacket: Ventureclad.
- D. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.045 inch thick, 48 inch wide roll; white color.

2.5 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad or welded with press-on head.
- E. Lagging Adhesive: Fire resistive to ASTM E84.
- F. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- G. Adhesives: Compatible with insulation.
- H. Membrane Adhesives: As recommended by membrane manufacturer.

2.6 EQUIPMENT INSULATION

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
 - 1. Thermal Conductivity: 0.24 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 450 degrees F.
 - 3. Density: 1.5 pound per cubic foot.
- B. TYPE E-2: Glass Fiber.
 - 1. Manufacturers:
 - a. Owens Corning Fiberglass.
 - b. Knauf.
 - c. Certainteed Corp.
 - d. Mansville.
 - e. Armstrong.
 - 2. Insulation: ASTM C547; rigid molded, noncombustible.
 - a. 'K' Value: ASTM C335, 0.24 at 75 degrees F.
 - b. Minimum Service Temperature: 0 degrees F.
 - c. Maximum Service Temperature: 250 degrees F.
 - d. Maximum Moisture Absorption: 0.2 percent by volume.
 - 3. Vapor Barrier Jacket:
 - a. ASTM C921, white kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
 - b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
 - c. Secure with self-sealing longitudinal laps and butt strips.

- d. Secure with outward clinch expanding staples and vapor barrier mastic.
- 4. Tie Wire: 18 gage stainless steel with twisted ends on maximum 12 inch center.
- 5. Vapor Barrier Lap Adhesive:
 - a. Compatible with insulation.
- 6. Insulating Cement/Mastic:
 - a. Manufacturers:
 - 1) Fibrex.
 - 2) Dabco.
 - b. ASTM C195; hydraulic setting on mineral wool.

2.7 EQUIPMENT INSULATION JACKETS

A. Vapor Retarder Jacket:

- 1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
- 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed and dry.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Install materials in accordance with manufacturer's instructions.
- B. On exposed piping, locate insulation and cover seams in least visible locations.
- C. For insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - 3. PVC fitting covers may be used.
 - 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump body and expansion joints.

- D. For insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with vapor barrier, factory applied or field applied.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 3. Finish with glass cloth and adhesive.
 4. PVC fitting covers may be used.
 5. For hot piping water do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. Insulated cold pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory applied or field applied.
 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 3. PVC fitting covers may be used.
 4. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 5. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- F. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 3. Insert Location: Between support shield and piping and under the finish jacket.
 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 5. Insert Material: Provide heavy density insulating material suitable for the planned temperature range.
- G. EPDM Cellular Elastomeric Insulation:
1. Insulating pipe saddles are to be installed at all pipe hanger and clamp locations. In new construction, saddles are to be installed at the time that piping is being installed, so that insulation system can be installed in a continuous manner through the pipe support system.
 2. Piping up to 16" inside diameter is to be insulated using preformed pipe insulation. Piping over 16" inside diameter may be insulated with preformed pipe insulation or sheet insulation, applied according to manufacturer's installation instruction and practices described in the National Commercial and Industrial Insulation Standards Manual.
 3. No additional coating or finish is required for weathering resistance. Coatings or jacket may be required for aesthetic, damage resistance, or vapor barrier enhancement purposes.
 4. At a minimum, thickness used will be in accordance with the thickness tables for piping insulation used in the latest version of ASHRAE 90.1. These thicknesses may or may not sufficient to control condensation. Thickness required to control condensation may be greater than the recommendations of ASHRAE E90.1.
 5. All longitudinal and butt joints shall have lap tape applied.
 6. Piping, Valves, Fittings:

- a. All piping, valves, and fittings scheduled to be insulated shall have all insulation applied in strict accordance with manufacturer's installation instructions, and practices described in the National Commercial and Industrial Insulation Standards Manual. Manufacturer's installation guidelines and instruction will be used if conflicts exist.
- H. Finish insulation at supports, protrusions, and interruptions.
- I. All fittings in fiberglass covered systems: Elbows, tees, valve bodies etc. shall be insulated with blanket insulation with equivalent thickness as the surrounding pipe and finished with PVC jackets.
- J. Provide insulated valve and thermometer extensions as required for the specified pipe insulation thickness.
- K. Exterior hot and chilled water pipes shall be covered with polyisocyanurate rigid foam. At a minimum, installation shall follow manufacturer's guidelines. Longitudinal seams and an additional strip of venturclad tape must be applied.
- L. High density foam must be below each hanger and shall be able to support the weight of the piping system.
- M. Interior chilled water piping and fittings shall be covered with phenolic foam insulation.
- N. At all fittings, provide a removable vinyl jacketed cover with Velcro seams and elastic ends around all valves in pipe mains shown on drawings in chilled temperature piping.

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. External Glass Fiber Duct Insulation:
 - 1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
 - 2. Secure insulation without vapor retarder with staples, tape, or wires.
 - 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Duct and Plenum Liner:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

3.4 PIPE SYSTEMS INSULATION SCHEDULE

<u>Piping Systems</u>	<u>Insulation Type</u>	<u>Pipe Size Inch</u>	<u>Thickness</u>
Hot Water Supply and Return	P-1	Up to 1-1/2" 2" and Up	1-1/2" 2"
Interior Metallic Cooling Coil Condensate Piping	P-2	Up to 4"	3/4"
Chilled/Dual Temp. Supply, and Return Water	P-2	1-1/4 to 5" 5" and Up	1-1/2" 2"
Exterior Chilled Water Supply & Return	P-3 *	Up to 10"	2-1/2" (with embossed Ventureclad vapor barrier jacket)

*Polyisocyanurate Rigid Foam: Standard 2.5LB Polyisocyanurate to be installed below hanger supports up to 4" pipe. For pipe larger than 4" 3LB Polyisocyanurate is to be installed below hanger supports.

3.5 DUCT SYSTEMS INSULATION SCHEDULE

<u>Ductwork</u>	<u>Insulation Type</u>	<u>Thickness</u>
Supply and Return Ducts	D-3	1-1/2"
Exhaust ductwork from exterior wall or roof to damper	D-1	1-1/2"
Transfer Duct	D-3	1"
Round Concealed Branch Ductwork	D-1	2"
Round Exposed Branch Ductwork (refer to double wall)	--	--

*Wrap the exterior of the ductwork with 2" Polyiso duct-board with a white embossed aluminum jacket. Provide 6 ml VentureClad Aluminum wrap (white).

END OF SECTION 230700

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
 - 1. Section 23 09 93 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.2 SCOPE OF WORK

- A. Expand and modify the existing temperature control system as required to include the new equipment and sequence of operation shown and described in the construction documents.

1.3 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
 - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
 - 7. Performance: Programmable controllers shall execute DOC PID control loops, and scan and update process values and outputs at least once per second.
 - 8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 5 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.

- k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
- l. Airflow (Terminal): Plus or minus 10 percent of full scale.
- m. Air Pressure (Space): Plus or minus 0.01-inch wg.
- n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
- o. Carbon Monoxide: Plus or minus 5 percent of reading.
- p. Carbon Dioxide: Plus or minus 50 ppm.
- q. Electrical: Plus or minus 5 percent of reading.

1.4 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - 1. DOC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 - 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 - 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
 - 4. Details of control panel faces, including controls, instruments, and labeling.
 - 5. Written description of sequence of operation.
 - 6. Schedule of dampers including size, leakage, and flow characteristics.
 - 7. Schedule of valves including flow characteristics
 - 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 - 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 - 10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.

- b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
- c. Written description of sequence of operation including schematic diagram.
- d. Points list.

1.5 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
- B. Qualification Data: For Installer and manufacturer.
- C. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- D. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.,-.
 - 5. Calibration records and list of set points.
- B. Software and Firmware Operational Documentation: Include the following:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
 - 5. Software license required by and installed for DDC workstations and control systems.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

- A. Coordinate location and type of thermostats, humidistats, and other exposed control sensors with the owner with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units.
- C. Coordinate equipment with Section 26 24 16 "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate equipment with documents to achieve compatibility with motor starters and annunciation devices.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Honeywell -WEBS Jace-AX.
 - 2. Tridium-Niagara-Vykon Jace-AX
 - 3. Siemens - Talon-Jace AX.
 - 4. Distech-EC-NET-Jace-AX.
 - 5. Schneider Electric -I/A Series-Jace AX
 - 6. Circon
 - 7. Johnson Controls

- B. The control equipment shall incorporate LonMark technology at the controller level and Niagara Frame AX version technology at the network device level and as network device level and as network management tool.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. All graphics associated with the controls work will be created and implemented under a separate contract by the school district's existing service provider.
 - 1. The system installed shall seamlessly connect devices other than HVAC throughout the building regardless of subsystem type, i.e. HVAC, lighting and security devices should easily coexist on the same network channel without the need for gateways.

2.3 DOC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Units monitor or control each I/O point; process information; execute commands from
 - 2. other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - 3. Stand-alone mode control functions operate regardless of network status. Functions
 - 4. include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 - 5. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PIO control, DOC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - d. Remote communications.
 - e. Maintenance management.
 - f. Units of Measure: Inch-pound and SI (metric).
 - 6. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

7. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.
- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.

2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
 3. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
 4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
 5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
 1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
 2. Proportional band shall extend from 2 to 20 percent for 5 psig.
 3. Authority shall be 20 to 200 percent.
 4. Air-supply pressure of 18 psig, input signal of 3 to 15 psig, and output signal of zero to supply pressure.

5. Gages: 1-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.6 TIME CLOCKS

A. Manufacturers:

1. ATC-Diversified Electronics.
2. Grasslin Controls Corporation.
3. Paragon Electric Co., Inc.
4. Precision Multiple Controls, Inc.
5. SSAC Inc.; ABB USA.
6. TCS/Basys Controls.
7. Theben AG - Lumilite Control Technology, Inc.
8. Time Mark Corporation.

- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.

- C. Solid-state, programmable time control with 4 separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.7 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Manufacturers:

- a. BEC Controls Corporation.
- b. Ebtron, Inc.
- c. Heat-Timer Corporation.
- d. I.T.M. Instruments Inc.
- e. MAMAC Systems, Inc.
- f. RDF Corporation.

2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.

- a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed.
 - d. Orientation: Vertical.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 3. Wire: Twisted, shielded-pair cable.
 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
 5. Averaging Elements in Ducts: 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 7. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed.
 - d. Orientation: Vertical.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- D. Humidity Sensors: Bulk polymer sensor element.
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Accuracy: 2 percent full range with linear output.
 3. Room Sensor Range: 20 to 80 percent relative humidity.
 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.

- a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Thermometer: Concealed.
 - d. Orientation: Vertical.
 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F.
 7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
 - d. Duct Static-Pressure Range: 0- to 5-inch wg.
 3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
 4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
 5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
 6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- F. Room Sensor Cover Construction: Plain stainless steel wall plate with 10k Type II thermistor.
1. Set-Point Adjustment: Concealed.
 2. Set-Point Indication: Concealed.
 3. Thermometer: Concealed.
 4. Orientation: Vertical.
- G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
 2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.
 3. Adjusting Key: As required for calibration and cover screws.

2.8 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.9 THERMOSTATS

- A. General: Thermostat/sensors types provided shall be coordinated with the district prior to purchase.
- B. Manufacturers:
 - 1. Erie Controls.
 - 2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
 - 3. Heat-Timer Corporation.
 - 4. Sauter Controls Corporation.
 - 5. tekmar Control Systems, Inc.
 - 6. Theben AG - Lumilite Control Technology, Inc.
- C. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever- operated fan switch.
 - 1. Label switches "FAN HIGH-MED-LOW-OFF".
 - 2. Mount on single electric switch box.
- D. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from set point.
 - 3. Set up for four separate temperatures per day.
 - 4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
 - 5. Short-cycle protection.
 - 6. Programming based on every day of week.
 - 7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
 - 8. Battery replacement without program loss.

9. Thermostat display features include the following:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed override.
 - f. Day of week.
 - g. System mode indications include "heating," "off," "fan auto," and "fan on."
- E. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set- point range, and 2 deg F maximum differential.
- F. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
 1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 2. Selector Switch: Integral, manual on-off-auto.
- G. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 1. Bulbs in water lines with separate wells of same material as bulb.
 2. Bulbs in air ducts with flanges and shields.
 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.

1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded- rubber diaphragm, remote-bulb liquid-filled element. direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.

2.10 HUMIDISTATS

A. Available Manufacturers:

1. MAMAC Systems, Inc.
2. ROTRONIC Instrument Corp.

B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.11 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Available Manufacturers:

- a. Belimo Aircontrols (USA), Inc.

2. Dampers: Size for running torque calculated as follows:

- a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
- b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
- c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
- d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
- e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
- f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.

5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Two-Position Spring Return): 24-V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-Vac or 8 Wat 24-V de.
8. Proportional Signal: 2- to 10-V de or 4 to 20 mA, and 2- to 10-V de position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F.
10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
11. Run Time: 12 seconds open, 5 seconds closed.

2.12 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.13 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with the owner, Drawings, and room details before installation. Install devices 60 inches above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
 - 1. Unsupervised areas.
 - 2. Public areas.
 - 3. Where indicated.
- E. Install automatic dampers according to Section 23 33 00 "Air Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- H. Install electronic and fiber-optic cables according to documents.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to documents.
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. DOC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check installation of air supply for each instrument.
 - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
 - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 8. Check temperature instruments and material and length of sensing elements.
 - 9. Check control valves. Verify that they are in correct direction.
 - 10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - 11. Check DOC system as follows:
 - a. Verify that DOC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare 1/0 capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

- A. Calibrating and Adjusting:
 - 1. Calibrate instruments.
 - 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
 - 3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
 - 4. Control System Inputs and Outputs:

- a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
 5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
 6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
 7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
 8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
 10. Provide diagnostic and test instruments for calibration and adjustment of system.
 11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: 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 three visits to Project during other than normal occupancy hours for this purpose.
- 3.6 COMMISSIONING
- A. The controls and HVAC contractor shall commission the system to assure proper operation of the equipment. The HVAC contractor shall provide a letter stating this has been completed and is operating as per the intent of the design.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Include a minimum of 12 hours of onsite training of instruction time. This is separate from commissioning and service calls. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**PART 1 - GENERAL****1.1 SUMMARY**

A. Section includes sequence of operation for:

1. Dedicated Outdoor Air Systems.
2. Electric Cabinet Unit Heaters.

B. d Sections:

1. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
2. Submit flow diagrams for each control system, graphically depicting control logic.
3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

1.4 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)

- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. Temperature control system shall be DDC as specified in Section 23 09 23 "Direct Digital Control System for HVAC" and Section 23 09 00 "Instrumentation and Control for HVAC".
- B. Temperature control system shall be web-based and communicate seamlessly, via BACnet. All DDC control points listed in this section shall be performed by the DDC system and displayed on a PC browser with Internet Explorer. For future work, new DDC system software shall have capability and sufficient capacity to control entire building and planned future addition plus 20 percent spare capacity.
- C. All DDC control points listed in this section shall be performed by the DDC system. Any other control work required to complete the sequence of operation herein specified shall be electric temperature controls. Contractor shall provide all transformers, relays, etc. necessary for a complete operating system.
- D. In general, system shall automatically control changeover to heating at 68 degrees F. (adjustable) and to cooling at 70 degrees F. (adjustable) as sensed by outside air temperature sensor.

3.2 CONSTANT VOLUME DEDICATED WATER SOURCE 100% OUTDOOR AIR UNITS (DOAU-1,2)

- A. Provide manufacturers controls with BACnet interface to existing building automation system. Coordinate with BAS contractor.
- B. Occupied Mode: The occupancy mode shall be controlled as programmed by the BAS.
- C. Unoccupied Mode: The unit shall not be in operation and the outdoor air damper shall be closed. The unit shall cycle as needed to meet unoccupied set points.
- D. Warm-up/Cooldown: The unit is available for use with the outside air damper closed and the return air damper open.

- E. Energy Recovery Operation: Defrost mode shall operate for proper unit function.
- F. Unit controller shall control leaving air temperature for heating, cooling or dehumidification.
- G. Supply Fan: The supply fan shall run continuously during occupied mode to provide the code required ventilation.
- H. Exhaust Fan: The exhaust fan shall be controlled to maintain an adjustable building static pressure setpoint.
- I. Provide a software adjustable low limit stat to stop the unit, close the outside air damper and open the return damper when the temperature drops below setpoint.
- J. Provide return air temperature and humidity sensors.
- K. Unit discharge air temperature and humidity may be reset from the BAS.
- L. Install and wire manufacturer's loose shipped items.
- M. Unit shall operate as a 100% outdoor air unit in occupied mode and 100% recirculation unit in unoccupied mode.
- N. Input/Output Schedule (minimum points required):

	<u>Description</u>	<u>Signal</u>
1.	Unit Start/Stop/Status	DO
2.	Supply Fan Status	DI
3.	Supply Fan Speed	AO
4.	Exhaust Fan Status	DI
5.	Exhaust Fan Speed	AO
6.	Discharge Air Temperature	AI
7.	Discharge Air Temperature Setpoint	AO
8.	Return Air Temperature	AI
9.	Return Air Humidity	AI
10.	Outdoor Air Damper	AO
11.	Return Air Damper	AO
12.	Cooling Stages	DO
13.	Heating Stages	DO
14.	Heating/Cooling Setpoint	AO
15.	Outdoor Air Temperature	AI
16.	Outdoor Air Humidity	AI
17.	Low Temperature Alarm	DI
18.	Heat Recovery Wheel Status	DI
19.	All additional points as requested by owner	All Points
20.	Graphic Display	--

3.3 ELECTRIC CABINET UNIT HEATERS (ECUH)

- A. Integral thermostat factory mounted by the unit manufacturer.

END OF SECTION 230993

SECTION 231123 - FACILITY NATURAL GAS PIPING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Natural gas piping above grade.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.

B. Related Sections:

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
2. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for valve and pipe identification for placement by this section.

1.2 REFERENCES**A. American National Standards Institute:**

1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. ASME B31.9 - Building Services Piping.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
6. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

E. American Water Works Association:

1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

G. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.9.
- D. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data:
 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
 - a. Strainers.
 - b. Natural gas pressure regulators.
 - c. Natural gas pressure relief valves.
- C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, piping system, and system components.
- C. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.6 QUALITY ASSURANCE

- A. Perform natural gas Work in accordance with NFPA 54.
- B. Perform work in accordance with applicable code and local gas company requirements.
- C. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- D. Perform Work in accordance with authority having jurisdiction and AWS D1.1 for welding hanger and support attachments to building structure.
- E. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

- B. Coordinate trenching, excavating, bedding, and backfilling of buried piping systems.

1.12 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.13 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
 - 2. Joints: Threaded for pipe 2 inches and smaller (unless routed through the building outside of mechanical rooms); welded for pipe 2-1/2 inches and larger.

2.2 UNIONS AND FLANGES**A. Unions for Pipe 2 inches and Smaller:**

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with brazed joints.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.3 PIPE HANGERS AND SUPPORTS**A. Conform to NFPA 54 and ASME 31.9.****B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.****C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.****D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.****E. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.****F. Vertical Support: Steel riser clamp.****G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.****H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.****I. Sheet Lead: ASTM B749, 2.5 lb/sq ft inch thick.****PART 3 - EXECUTION****3.1 EXAMINATION****A. 01300 - Administrative Requirements: Coordination and project conditions.****B. Verify excavations are to required grade, dry, and not over-excavated.****3.2 PREPARATION****A. Ream pipe and tube ends. Remove burrs.****B. Remove scale and dirt, on inside and outside, before assembly.****C. Prepare piping connections to equipment with flanges or unions.**

3.3 INSTALLATION - INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with ASME B31.9.
- B. Support horizontal piping hangers as scheduled.
- C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- F. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
- G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
- H. Provide copper plated hangers and supports for copper piping and sheet lead packing between hangers or support and piping.
- I. Prime coat exposed steel hangers and supports in accordance with Section 09 90 00.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.5 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Install natural gas piping in accordance with NFPA 54.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.
- H. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
- I. Provide clearance for installation of insulation and access to valves and fittings.
- J. Provide access where valves and fittings are not exposed.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
- L. Provide support for utility meters in accordance with requirements of utility company.
- M. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.
- N. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09 90 00.
- O. Install identification on piping systems including underground piping. Refer to Section 23 05 53.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- R. Install gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.
- S. Install gas pressure regulator with tee fitting not less than 10 pipe diameters downstream of regulator. Cap or plug one opening of tee fitting.
- T. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.
- U. Provide new gas service complete with gas meter and regulators. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.
- V. All exterior gas pipe and gas vent piping shall be brushed clean, primed and painted with two coats of weather resistant oil base paint (color selected by Architect).
- W. All valves located 7'-0" and above shall have chain mounted operation.

3.6 FIELD QUALITY CONTROL

- A. Pressure test natural gas piping in accordance with NFPA 54.
- B. Inspect, test and purge gas piping in accordance with applicable code.

- C. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

END OF SECTION 231123

SECTION 233100 - HVAC DUCTS AND CASINGS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Duct Materials.
2. Flexible ducts.
3. Insulated flexible ducts.
4. Single wall spiral round ducts.
5. Double wall spiral ducts.
6. Ductwork fabrication.

B. Related Sections:

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
2. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES**A. ASTM International:**

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
10. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - Fibrous Glass Duct Construction Standards.
2. SMACNA - HVAC Air Duct Leakage Test Manual.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
 3. Fittings.
 4. Reinforcing details and spacing.
 5. Seam and joint construction details.
 6. Penetrations through fire rated and other walls.
 7. Terminal unit and coil installations.
 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- C. Product Data: Submit data for duct materials and duct liner.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- E. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)

- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of in conformance with ASTM A90.

2.2 MANUFACTURED DUCTWORK

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- 1. Unless otherwise noted, all duct and fittings shall be G-90 galvanized steel in accordance with ASTM A-653 and A-924 and exposed duct shall be paint grip ready.

- B. Insulated Flexible Ducts:

- 1. Manufacturers:

- a. Flex-Master.
 - b. Therma Flex.
 - c. Techna Flex.

- 2. Underwriters Laboratory Standard 181; Class 1.
 - 3. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
 - 4. Pressure Rating: 10 inches w.g. positive and 1.0 inches w.g. negative.
 - 5. Maximum Velocity: 4000 fpm.

2.3 SINGLE WALL INSULATED SPIRAL DUCTWORK

- A. General:

- 1. The duct system shall consist of fittings that are factory fitted with a sealing gasket. The spiral duct fitting will seal the duct joints without the use of duct sealer.

- B. Materials:

- 1. Unless otherwise noted, all duct and fittings shall be G-90 galvanized steel in accordance with ASTM A-653 and A-924.

- C. Construction:

- 1. Fittings:

- a. All fitting ends shall come factory equipped with a EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet the performance criteria set forth in the manufacturer's

literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.

- b. All fittings shall be furnished with gasket on the outer shell.
- c. All fittings ends shall be calibrated to manufacturer's published dimensional tolerance standard.
- d. All fitting ends O.D. shall have rolled over edges for added strength and rigidity during installation and shipping.
- e. Transitions shall be provided where insulated duct connects to non-insulated, single wall duct. Transitions also act as insulation ends reducing the double wall outer shell diameter to the inner shell diameter.
- f. When contract documents require divided flow fittings, only full body fittings will be accepted. Saddle taps are unacceptable.

2. Spiral Duct:

- a. Spiral duct shall be calibrated to manufacturer's published dimensional tolerance standard.
- b. All spiral duct 12" Dia. and larger shall be corrugated for added strength and rigidity. The duct will be of spiral lockseam construction.
- c. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.

3. When gasket or flanges are not acceptable the duct shall be welded construction.

2.4 DOUBLE WALL INSULATED ACOUSTICAL SPIRAL DUCTWORK

A. General: All exposed round supply ductwork shown on the plans or indicated in the project specification to be insulated shall be Double Wall. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct and will seal the duct joints without the use of duct sealer.

B. Materials:

- 1. Unless otherwise noted, all duct and fittings shall be G-90 galvanized steel in accordance with ASTM A-653 and A-924 and exposed duct shall be paint grip ready.
- 2. Perforated liner on double wall duct only shall consist of 1/8 inch perforations on 1/4 inch staggered centers corresponding to an overall open area of 23%.
- 3. Fiber glass insulation shall have a maximum conductivity factor (K) of 0.26 BTU-in/hr • ft²•°F at 75 °F mean ambient temperature.
- 4. Retaining fabric shall be 0.008 inch thick, 15.6 lb/ft³ density with an air permeability rate of 9.2 ft³/ft² •s.

C. Construction:

1. Fittings:

- a. All double wall fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.

- b. Double wall duct and fittings shall consist of a perforated or solid inner liner, a 1 inch, 1.50 lb/ft³ (unless otherwise specified) layer of fiber glass insulation and a solid outer pressure shell. When a perforated inner liner is specified, a retaining fabric shall be wrapped between the perforated inner and the fiber glass insulation. The fabrics provide fiber glass tear retention while maintaining the desired acoustical properties. For 1-inch thick insulation, the outer pressure shell diameter shall be 2 inches larger than the inner liner.
- c. All fittings shall be furnished with gasket on the outer shell. The inner shell on all double wall fittings shall extend a minimum of 1" past the outer shell.
- d. All fittings ends shall be calibrated to manufacturer=s published dimensional tolerance standard.
- e. All fitting ends O.D. shall have rolled over edges for added strength and rigidity during installation and shipping.
- f. Double wall to single wall transitions shall be provided where insulated duct connects to non-insulated, single wall duct. Transitions also act as insulation ends reducing the double wall outer shell diameter to the inner shell diameter.
- g. When contract documents require divided flow fittings, only full body fittings will be accepted. Double wall saddle taps are unacceptable.
- h. All double wall duct and fittings shall be furnished with both an inner liner and a outer pressure shell coupling. The inner liners shall not be fastened together to allow for expansion and contraction.

2. Spiral Duct:

- a. Spiral duct shall be calibrated to manufacturer=s published dimensional tolerance standard.
- b. All spiral duct 12" Dia. and larger shall be corrugated for added strength and rigidity. Inner and outer duct will be of spiral lockseam construction.
- c. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.

2.5 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.
- G. Connect flexible ducts to metal ducts with draw bands.
- H. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- I. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- J. Connect terminal units to supply ducts with three foot maximum length of flexible duct. Do not use flexible duct to change direction.
- K. Cleaning and Protection:
 - 1. Clean air handling unit and ductwork prior to the installation. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
 - 2. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

3.2 SCHEDULES

- A. Ductwork Material Schedule:

<u>AIR SYSTEM</u>	<u>MATERIAL</u>
Supply	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Any Exposed Round Ductwork	Galvanized Double Wall Spiral

B. Ductwork Pressure Class Schedule:

<u>AIR SYSTEM</u>	<u>PRESSURE CLASS</u>	<u>SEAL CLASS</u>
Supply Duct (upstream of VAV boxes)	8 inch wg.	A
Return Duct	3 inch wg.	B
Relief/Return	2 inch wg.	C
Variable Air Volume Supply (downstream of VAV boxes)	2 inch wg min.	C
General Exhaust	2 inch wg	C
Transfer duct	1 inch wg	

END OF SECTION 233100

SECTION 233300 - AIR DUCT ACCESSORIES**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Back-draft dampers.
2. Duct access doors.
3. Volume control dampers.
4. Flexible duct connections.
5. Duct test holes.
6. Dynamic fire dampers.
7. Fire/smoke dampers.

B. Related Sections:

1. Section 23 09 00 - Instrumentation and Control for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
2. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
3. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.2 REFERENCES**A. Air Movement and Control Association International, Inc.:**

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:

1. UL 555 - Standard for Safety for Fire Dampers.
2. UL555S- Standard for Safety for Smoke Dampers

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.
- C. Product Data: Submit data for shop fabricated assemblies and hardware used.
- D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
 - 1. Fire dampers including locations and ratings.
 - 2. Backdraft dampers.
 - 3. Flexible duct connections.
 - 4. Volume control dampers.
 - 5. Duct access doors.
- E. Product Data: For fire dampers submit the following:
 - 1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
 - 2. Indicate materials, construction, dimensions, and installation details.
 - 3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- F. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access doors.
- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

- A. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

- B. Protect dampers from damage to operating linkages and blades.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- D. Storage: Store materials in a dry area indoor, protected from damage.
- E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two of each size and type of fusible link.

1.10 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 AIR TURNING DEVICES**

- A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.2 BACKDRAFT DAMPERS

- A. Manufacturers:

- 1. Greenheck.
- 2. Cook.
- 3. Ruskin.
- 4. Dowco Products
- 5. Carnes
- 6. Vent Products.
- 7. Pottorff.

- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage thick galvanized extruded aluminum, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

- A. Manufacturers:

- 1. Ruskin.
- 2. Cesco Products.
- 3. Carnes.
- 4. Vent products.
- 5. Pottorff.

- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

- C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

- 1. Less than 12 Inches Square: Secure with sash locks.
- 2. Up to 18 Inches Square: Provide two hinges and two sash locks.

- D. Access doors with sheet metal screw fasteners are not acceptable.

2.4 VOLUME CONTROL DAMPERS**A. Manufacturers:**

1. Ruskin.
2. Vent Products.
3. Dowco Products.
4. Air Balance Inc.
5. Pottorff.
6. Greenheck.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.**C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.****D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inches. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.****E. Quadrants:**

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Access doors shall be rated for the same pressure clad as the duct system.

F. Remote Operator: Provide Young Regulator or equal, remote operator where damper access cannot be attained through ceiling access door. Operator to be by cable through 7/18" diameter paintable cold rolled steel cover plate concealing socket wrench operated rack and pinion gear drive. Damper shall be complete with similar gear drive smoothly to operate damper through full range of motion from tight shut-off to wide open.**2.5 FLEXIBLE DUCT CONNECTIONS****A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.****B. Connector: Fabric crimped into metal edging strip.**

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
2. Net Fabric Width: Approximately 3 inches wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

C. Lead Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.**2.6 DUCT TEST HOLES****A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.**

- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 DYNAMIC FIRE DAMPERS

A. Manufacturers:

1. Ruskin.
2. Vent Products.
3. Dowco Products.
4. Air Balance, Inc.
5. Cesco Products.
6. Greenheck.
7. Pottorf.

- B. Fabricate in accordance with NFPA 80, 90A, 101 and UL 555, and as indicated.

- C. All dampers shall be mounted in a sleeve of sufficient length and gauge to meet UL installation requirements. The sleeve shall be held in place with retaining angles.

- D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring.

- E. Curtain Type Dampers: Galvanized steel with interlocking blades, 3.688 inches frame, blades in gauges required by UL. Provide stainless steel closure springs and latches for horizontal installations, closure under minimum 2000 fpm air flow conditions @ 4inches w.g. Configure with blades out of air stream except for pressure class ducts up to 12 inches in height.

- F. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock. The damper shall have a dynamic closure under minimum 2000 fpm air flow conditions @ 4inches w.g

- G. Fusible Links: UL 33, separate at 165 degrees F. with adjustable link straps.

- H. Security Bars (provide only in storm shelter area): 3 1/2" x 3 1/2" custom grid provided by the installing contractor.

1. Vertical Bars: 1/2" diameter zinc plated bar. 3 1/2" on center.
2. Horizontal Bars: 2" x 1/4" flat bar. 3 1/2" on center.
3. Grille Frame: 10 gauge x2" galvanized steel.
4. Vertical bars pass through the horizontal bars. Bars are welded to the frame and at each intersection of the horizontal bars

2.8 DYNAMIC FIRE/SMOKE DAMPERS

A. Manufacturers:

1. Ruskin.
2. Vent Products.
3. Greenheck.
4. Pottorf.

- B. Fabricate in accordance with NFPA 80, 90A, 101 and UL 555, UL 555S and as indicated.
- C. All dampers shall be mounted in a sleeve of sufficient length and gauge to meet UL installation requirements. The sleeve shall be held in place with retaining angles.
- D. Multiple Blade Dampers: 16 gage galvanized steel frame and air foil blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage. The damper shall have a dynamic closure under minimum 2000 fpm air flow conditions @ 4inches w.g
- E. Fire/Smoke damper shall be UL listed, similar to Ruskin FSD60.
- F. Fire Smoke dampers shall include 120 volt actuators, factory mounted, normally closed with spring return
- G. High temperature thermal link set at 165 degrees for damper closure.
- H. Security Bars (provide only in storm shelter area): 3 1/2" x 3 1/2" custom grid provided by the installing contractor.
 - 1. Vertical Bars: 1/2" diameter zinc plated bar. 3 1/2" on center.
 - 2. Horizontal Bars: 2" x 1/4" flat bar. 3 1/2" on center.
 - 3. Grille Frame: 10 gauge x2" galvanized steel.
 - 4. Vertical bars pass through the horizontal bars. Bars are welded to the frame and at each intersection of the horizontal bars

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, fire and smoke dampers, and elsewhere as indicated. Provide minimum 18 x 18 inch size for shoulder access or 2 inches smaller than duct size, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Demonstrate re-setting of fire dampers to Owner's representative.

- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233700 - AIR INLETS AND OUTLETS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Grilles, Registers, Diffusers.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
2. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES**A. Air Movement and Control Association International, Inc.:**

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Submittal procedures.****B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.****C. Test Reports: Rating of air outlet and inlet performance.****D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.****1.4 CLOSEOUT SUBMITTALS****A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.****B. Project Record Documents: Record actual locations of air outlets and inlets.****1.5 QUALITY ASSURANCE****A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.****B. Test and rate louver performance in accordance with AMCA 500.**

1.6 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Titus.
- B. Carnes.
- C. Metal-Air.
- D. Price.
- E. Nailor.

2.2 PLAQUE CEILING DIFFUSERS (Type A)

- A. Type: Square, plaque, air deflector to discharge air in 360 degree pattern.
- B. Frame: To match ceiling type.
- C. Fabrication: Steel with baked enamel finish as selected by Architect.
- D. Accessories: Radial opposed blade damper.

2.3 CEILING GRID CORE RETURN REGISTERS/GRILLES (Type B)

- A. Type: Fixed grilles of 1/2" x 1/2" grid 1" high or fixed grilles of 1/2" x 1/2" grid 1/2" high with 45 degree angle blades.
- B. Frame: 1-1/4 inch margin with lay-in frame for suspended grid ceilings.
- C. Fabrication: Aluminum with factory off-white enamel finish.

2.4 ROUND MULTI-CONE CEILING DIFFUSERS (Type C)

- A. Type: Round, multi-cone, air deflector to discharge air in 360-degree pattern.
- B. Frame: To match ceiling type.
- C. Fabrication: Steel with baked enamel finish as selected by Architect.
- D. Accessories: Radial opposed blade damper.

2.5 RETURN GRILLES AND REGISTERS (Type D)

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Aluminum with 20 gage minimum frames and 22 gage minimum blades. Aluminum frame, or aluminum extrusions, with factory off-white enamel finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.6 ADJUSTABLE SUPPLY, RETURN GRILLES AND REGISTERS (Type E)

- A. Type: Double deflection streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades. Steel with 20 gage minimum frame, and aluminum extrusions, with factory off-white enamel finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.7 VAV CEILING DIFFUSERS (Type F)

- A. Type: Square, thermally powered with variable air volume modulation. Thermostats are self-contained and controls both heating and cooling.
- B. Frame: Inverted t-bar type.
- C. Fabrication: Steel with baked enamel finish as selected by architect.

- D. Warranty: Ten years.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean opening thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets (louvers) matte black with weather resistant paint specific for outdoor applications.
- F. Install joint sealants as specified in Section 07 92 00.
- G. Apply field topcoat within 6 months of application of shop prime coat. Apply field topcoat as specified in Section 09 91 00.

3.4 CLEANING

- A. Clean louver surfaces in accordance with manufacturer's instructions.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 233700

SECTION 238103 - PACKAGED ROOFTOP AIR CONDITIONING UNITS WITH ENERGY WHEEL – SMALL CAPACITY**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Packaged rooftop air conditioning unit.
2. Roof curb.

B. Related Sections:

1. Section 23 05 53 - Mechanical Identification
2. Section 23 05 93 - Testing, Adjusting, and Balancing.
3. Section 23 07 00 - Ductwork Insulation.
4. Section 23 09 00 - Instrumentation and Controls.
5. Section 23 11 23 - Facility Natural-Gas Piping: Natural gas piping connections.
6. Section 23 33 00 - Air Duct Accessories: Flexible connection.
7. Section 26 05 03 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES**A. Air-Conditioning and Refrigeration Institute:**

1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
3. ASHRAE 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings.

D. ASTM International:

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.
2. NFPA 58 - Liquefied Petroleum Gas Code.

3. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 DEFINITIONS

- A. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btuh to total rate of electric input in watts under designated operating conditions.
- B. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by total electric energy input during the same period (in Wh).

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit data indicating:
 1. Cooling and heating capacities.
 2. Dimensions.
 3. Weights.
 4. Rough-in connections and connection requirements.
 5. Duct connections.
 6. Electrical requirements with electrical characteristics and connection requirements.
 7. Controls.
 8. Accessories.
- C. Submit unit performance data including: capacity, nominal and operating performance.
- D. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- E. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
- F. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
- G. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of controls installed remotely from units.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept units on site. Inspect for damage.
- C. Protect units from damage by storing off roof until roof mounting curbs are in place.

1.8 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

1.9 WARRANTY

- A. Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.
- B. Manufacturer shall provide first year labor warranty. Warranty shall begin when unit is started.
- C. Furnish five year manufacturer's warranty for compressors.
- D. Furnish ten year manufacturer's warranty for heat exchangers.

1.10 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.
- C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one set of fan motor drive belts for each unit.
- C. Furnish one complete set of replacement filters for each unit.

1.12 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 ROOFTOP UNITS**

- A. The contractor shall furnish and install package rooftop units as shown and scheduled on the contract documents. The units shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. Manufacturers:
 - 1. Aaon.
 - 2. Trane.

3. Carrier.
4. Daikin.
5. JCI/York

C. General Unit Description:

1. Units furnished and installed shall be heating/cooling packaged rooftop(s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on ARI Standard 210. Units shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, indirect gas fired burner/heat exchanger, evaporator coil, return-air filters, supply motors and unit controls and drives.
2. Units shall be 100% factory run tested and fully charged with R-410A.
3. Units shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
4. Units shall be horizontal supply and downflow return airflow as manufactured.
5. Wiring internal to the unit shall be colored and numbered for identification.
6. Units shall be insulated double wall construction.

D. Unit Casing:

1. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 16 gauge with access doors and removable panels of minimum 20 gauge.
2. Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
3. Cabinet construction shall allow for all service/ maintenance from one side of the unit.
4. Cabinet top cover shall be one piece construction or where seams exists, it shall be double-hemmed and gasket-sealed.
5. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return/exhaust air fan section, supply air fan section, evaporator coil section, and unit control section.
6. Downflow unit's base pans shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
7. Insulation: Provide 1/2 inch thick, fire retardant, coated fiberglass insulation on all exterior panels in contact with the return and conditioned air stream.
8. Provide openings either on side of unit or thru the base for power, control and gas connections.
9. The base of the unit shall have provisions for forklift and crane lifting.

E. Air Filters:

1. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Two inch thick, MERV 13, pleated glass fiber disposable media filters shall be provided.

F. Fans and Motors:

1. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan or direct drive backward-curved plenum type fan.

2. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Provide direct drive supply and exhaust/return fans with variable speed drives.
4. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.
5. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
6. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

G. Gas Fired Heating Section:

1. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping through the side of the unit.
2. Heating section shall be factory run tested prior to shipment.
3. Induced draft combustion type with direct spark ignition system. Gas Burner shall be forced combustion type power burner, negative pressure gas valve, manual shut-off, flame sensing safety control, and modulating heat.
4. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Upon a failure to ignite, two attempts of ignition will occur before lockout of the ignition system. Provide flame rollout switches.
5. Induced draft combustion blower shall have air proving switches and built-in thermal overload protection on fan motor.
6. Heat Exchanger: Provide tube heat exchanger section type manufactured from stainless steel, factory pressure and leak tested.
7. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

H. Evaporator Coil:

1. Provide configured microchannel aluminum fin surface mechanically bonded to copper tubing coil.
2. Provide an independent expansion device for each refrigeration circuit. Factory pressure test at 450 psig and leak test at 200 psig.
3. Provide double sloped drain pan for base of evaporator coil constructed of PVC with external connections.

I. Condenser Section:

1. Provide internally finned seamless copper tube mechanically bonded to configured aluminum fins. Factory pressure test to 450 psig.
2. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.
3. Provide hail guards.

J. Refrigeration System:

1. Compressors: Provide suction gas cooled motor with winding temperature limits and compressor overloads.
2. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
3. Provide each unit with refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.
4. Compressors: Provide direct drive variable capacity scroll compressors.

K. Exhaust/Return Section:

1. Provide, on downflow units a factory supplied field installed power exhaust assembly that shall assist the barometric relief damper in the economizer in relieving building pressurization.
2. Exhaust/return fans shall be equipped with variable frequency drives.

L. Outdoor Air Section:

1. Provide a fully integrated field-installed 100% modulating outside air economizer with unit return and barometric relief air dampers (downflow only), minimum position setting, preset linkage, wiring harness with plug. Unit operation is through primary temperature controls that automatically modulate dampers to maintain space temperature conditions.
2. Provide economizer with dual differential enthalpy controls.
3. Provide adjustable minimum position control located in the economizer section of the unit.
4. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

M. Service Outlet:

1. Provide factory wired 115 volt service outlet.

N. Energy Recovery (refer to schedule):

1. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
4. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels.

5. Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
6. Hinged service access doors shall allow access to the wheel.
7. Unit shall include energy recovery wheel defrost control which includes an adjustable temperature sensor and timer wired to periodically stop the wheel rotation, which allows the warm exhaust air to defrost the wheel.

a. Polymer Energy Recovery Wheels

8. Shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
9. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive.
10. Polymer Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by the manufacture. The 5-year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the manufacture written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the manufacturer's limited warranty certificate.
11. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

O. Operating Controls:

1. Provide manufacturers DDC ready controls with BACnet communications to interface with existing BAS.
2. Provide factory-wired roof top units with 24 volt control circuit with control transformers, contactor pressure lugs or terminal block for power wiring. Contractor to provide field-installed unit-mounted disconnect switch. Units shall have single point power connections. Field wiring of zone controls to be NEC Class II.
3. Coordinate thermostat with districts building automation contractor.
4. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
5. Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

6. Economizer Preferred Cooling (if supplied with economizer) - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

2.2 ROOF CURB

- A. Contractor shall provide insulated vibration isolation roof curb, 14 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Curb shall be a minimum height to be 18" above high point of roof.
- B. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Contractor shall verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Contractor shall verify that proper power supply is available.

3.2 INSTALLATION

- A. Contractor shall install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 INSTALLATION - NATURAL GAS HEATING SECTION

- A. Connect natural gas piping in accordance with NFPA 54.
- B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
- C. Install natural gas piping accessories.

3.4 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install new throwaway filters in units at Substantial Completion.
- D. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

END OF SECTION 238103

SECTION 238200 - CONVECTION HEATING AND COOLING UNITS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Electric Cabinet unit heaters.

B. Related Sections:

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
3. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.2 REFERENCES**A. Air-Conditioning and Refrigeration Institute:**

1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS**A. Section 01 33 00 - Submittal Procedures: Submittal procedures.****B. Shop Drawings:** Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.**C. Product Data:** Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.**D. Manufacturer's Installation Instructions:** Submit assembly, support details, and connection requirements.**E. Manufacturer's Certificate:** Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.
- C. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 COORDINATION:

- A. Coordinate layout and installation of air curtains, mounting system and all components associated with the air curtains with other construction.
- B. Notify the architect/engineer of any coordination conflicts prior to installation of the air curtain or other associated parts and accessories so that the installation can be coordinated prior to installation. Any installation that is commenced or completed without coordination is subject to rejection of the work and must be redone as required to meet the intent of the contract documents.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept units on site in factory packing. Inspect for damage. Store under roof.
- C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two sets of filters.

1.10 WARRANTY

- A. Provide manufacturer's standard warranty for replacement of parts for a period of 2-years from the time of installation. The warranty must cover all parts, components, accessories, etc. provided with the air curtain whether or not the parts, components or accessories are the direct product manufactured by the air curtain manufacturer.

1.11 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 ELECTRIC CABINET UNIT HEATER**

- A. Manufacturers:
 - 1. Q-Mark.
 - 2. Markel.
 - 3. Redding-TPI.
- B. Heaters shall be designed for a range of heating outputs. Units shall be available in wattages from 3,000 to 50,000 and voltages of 208, 240, 277, 480 and 600 in single and 3 phase options.
- C. Enclosures shall be 20 gauge (.035" min.) galvanized steel enclosure, deep drawn to add rigidity. Enclosure designed to withstand heavy-duty commercial and institutional use.
 - 1. Enclosures shall be chemically-treated to resist corrosion and then finished in baked enamel powder coating. Finish shall be mar and temperature-resistant. Color to be White.

2. Wiring compartment to be located at the right side of the heater with a hinged door to allow full access to wiring and controls. Enclosure to include knockouts for wiring and locations for optional accessories.
 3. Enclosure to include removable grilles so that the orientation of the inlet and outlet air can be changed on site.
 4. Enclosure designed to allow for horizontal or vertical installation.
- D. Heaters shall be designed with advanced pull through airflow to allow air to be pulled across the elements for cooler element operation.
- E. Motor shall be direct drive, permanently lubricated, totally enclosed.
- F. Heating elements shall be constructed with nickel chromium wire encased in a steel sheath or stainless steel sheath, and MgO material. Aluminum fins are to be designed for a chimney effect to maximize airflow and pressure bonded to the steel sheath for efficient heat transfer. Elements shall be U-shaped to maximize heat transfer.
- G. Built-in optional controls shall be capable of installing in the standard unit enclosure with no separate control box needed. The built-in optional controls shall single pole thermostat, two stage thermostat, Digital Touchscreen Thermostat with BMS, and power disconnect switch.
- H. Additional accessories include base kit, trim kit, and ducting options.
- I. Heater shall include an automatic reset thermal overload protector that shall run the full-length of the heater and shall turn off heating elements should overheating occur at any point along heating length. Automatic reset overload protector shall restore operation automatically when cause of overheating is removed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. For recessed units, verify recess dimensions are correct size.
- C. Verify wall construction is ready for installation.
- D. Verify ductwork is ready for installation.
- E. Verify concealed blocking and supports are in place and connections are correctly located.
- F. Examine the installation location where each air curtain will be installed to confirm that the installation location is in accordance with the Contract Documents and the Manufacturer's Installation Instructions.
- G. If there are any concerns regarding the installation location with respect to any aspect of the installation or performance of the air curtain notify the architect/engineer in order to resolve the concern.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use temporary filters for equipment start-up. After owner acceptance install final filters.
- C. On water coils, install shut-off valve on supply piping and lockshield balancing valve on return piping. Locate water supply at bottom of supply header and return water connection at top. Install manual air vents at high points complete with stop valve. Install water coils to be drainable and install drain connection at low points. Refer to Section 23 21 13.
- D. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- E. Install coils level.
- F. Make connections to coils with unions and flanges.
- G. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 23 07 00.
- H. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.
- I. Protection: Install finished cabinet units with protective covers during remainder of construction.
- J. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.
- K. Protection: Install finished cabinet units with protective covers during remainder of construction.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
- B. After installing air curtains completely, perform visual and mechanical check of individual components.
- C. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Repair or replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

- A. Adjust air-directional vanes.

3.5 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- D. Install new filters.
- E. Air Curtain:
 - 1. Clean the outside of each air curtain of any dirt, debris, grease, grime or other material.
 - 2. Clean the inside of each air curtain of any dirt, debris, grease, grime or other material as necessary to ensure proper operation. Remove any loose debris that may be of harm to the air curtain operation.
 - 3. Remove, clean and reinstall the cleanable air filters.

3.6 DEMONSTRATION

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 77 00 for general contractor closeout requirements. Refer to individual sections for specific contractor training requirements.

END OF SECTION 238200

SECTION 26 05 03 - EQUIPMENT WIRING CONNECTIONS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Submittal procedures.
- B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.4 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.

1.5 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)

- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

- A. Manufacturers:
 - 1. Hubbell.
 - 2. Leviton.
 - 3. Pass and Seymour.
 - 4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Attachment Plug Construction: Conform to NEMA WD 1.
- C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.
- D. Cord Construction: Type SJO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- E. Size: Suitable for Connected Load of Equipment, Length of Cord, and Rating of Branch Circuit Overcurrent Protection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.3 ADJUSTING

- A. Section 01 77 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 260503

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes building wire and cable and wiring connectors and connections.
- B. Related Sections:
 - 1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
 - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for control circuits.
 - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 4. Conductor not smaller than 16 AWG for control circuits.
 - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
 - 2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
 - 3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN insulation, in raceway.
 - 4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

5. Exterior Locations: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.
6. Underground Locations: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet when tested in accordance with NFPA 262.
- B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

- A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 ft of length shown.

1.11 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)

- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. American Insulated Wire Corp.
 - 2. General Cable Co.
 - 3. Pirelli Cable.
 - 4. Republic Wire.
 - 5. Rome Cable.
 - 6. Southwire.
 - 7. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 90 degrees C.
- F. Insulation Material: Thermoplastic.

2.2 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed compression type copper, with insulating sealing collars.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify interior of building has been protected from weather.
- B. Verify mechanical work likely to damage wire and cable has been completed.
- C. Verify raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques - Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.
- E. Special Techniques - Cable:
 - 1. Protect exposed cable from damage.
 - 2. Support cables above accessible ceiling, using spring metal clips or plenum rated plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
 - 3. Use suitable cable fittings and connectors.
- F. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - 7. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

- G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

- A. General:
 - 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
 - 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
 - a. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - b. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
 - 1. For 6 AWG and smaller: Green.
 - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

- A. Section 01 45 33 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.

1.2 REFERENCES**A. ASTM International:**

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, and UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

- B. Surface Burning: ASTM E84 and UL 723 with maximum flame spread / smoke developed rating of 25/450.

- C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to applicable code and UL for fire resistance ratings and surface burning characteristics.

- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers, where required.

- C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 25 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 25 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.
- E. In pool equipment rooms or rooms open to the pool, all hangers, inserts, slotted channels, rods, fasteners, etc. shall be stainless steel or epoxy coated to prevent corrosion.

1.11 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)

- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
1. Allied Tube & Conduit Corp.
 2. Electroline Manufacturing Company.
 3. O-Z Gedney Co.
 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. self-locking.
- G. In pool equipment rooms or rooms open to the pool provide stainless steel or epoxy coating to prevent corrosion.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
1. Allied Tube & Conduit Corp.
 2. B-Line Systems.
 3. Midland Ross Corporation, Electrical Products Division.
 4. Unistrut Corp.
 5. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.
- C. In pool equipment rooms or rooms open to the pool provide stainless steel or epoxy coating to prevent corrosion.

2.3 SPRING STEEL CLIPS

- A. Manufacturers:
1. B-Line Systems.
 2. Erico, Inc.
 3. Thomas & Betts Corp.

4. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: Mounting hole and screw closure.

C. In pool equipment rooms or rooms open to the pool provide stainless steel or epoxy coating to prevent corrosion.

2.4 SLEEVES

A. Sleeves for cabling Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for cabling Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for conduits or cabling Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Stuffing Type Fire-stopping Insulation: Glass fiber type, non-combustible.

E. In pool equipment rooms or rooms open to the pool provide stainless steel or epoxy coating to prevent corrosion.

2.5 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation.
3. Wiremold.
4. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.
7. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Foam compound.

3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

- C. Color: Where fire proofing will be visible after construction, provide products as selected by the architect products from manufacturer's full range of colors.

2.7 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.
 4. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products.
 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing and/or damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Obtain permission from Architect or Structural Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS**A. Anchors and Fasteners:**

- 1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors and preset inserts.
- 2. Steel Structural Elements: Provide beam clamps, steel ramset fasteners, and welded fasteners.
- 3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
- 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
- 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
- 6. Sheet Metal: Provide sheet metal screws.
- 7. Wood Elements: Provide wood screws.

B. Inserts:

- 1. Install inserts for placement in concrete forms.
- 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with NEC.**D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.****E. Install multiple conduit runs on common hangers.****F. Supports:**

- 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
- 2. Install surface mounted cabinets and panelboards with minimum of four anchors.

3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- F. Place intumescent coating in sufficient coats to achieve rating required.
- G. Remove dam material after firestopping material has cured.
- H. Fire Rated Surface:
 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 2. Where cable tray, conduit, wireway, trough, and cabling penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- I. Non-Rated Surfaces:
 1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 2. Install escutcheons, floor plates, or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- G. Install escutcheons at finished surfaces to match surrounding surfaces.

3.7 FIELD QUALITY CONTROL

- A. Section 01 45 33 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Section 01 77 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.
 - 5. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Raceways and boxes located in the pool equipment room or rooms open to the pool shall be PVC coated rigid steel. PVC conduit shall be acceptable concealed in or below floor slab and walls. PVC schedule 80 conduit shall be permitted to be routed exposed within the pool equipment room due to the corrosive influences.
- C. Underground More than 5 feet outside Foundation Wall: Provide rigid steel conduit. Thickwall nonmetallic conduit may be utilized where approved by the authority having jurisdiction. Provide cast metal boxes or nonmetallic handhole.
- D. Underground within 5 feet from Foundation Wall: Provide rigid steel conduit. Thin-wall nonmetallic conduit may be utilized where approved by the authority having jurisdiction. Provide cast metal or nonmetallic boxes.

- E. Under Slab on Grade: Provide rigid steel conduit. Thin-wall nonmetallic conduit may be utilized where approved. Provide cast or nonmetallic metal boxes.
- F. Outdoor Locations, Above Grade: Provide rigid steel and aluminum conduit. Provide cast metal, pull, and junction boxes.
- G. In Slab above Grade: Provide rigid steel conduit and intermediate metal conduit. Thickwall nonmetallic conduit may be utilized where approved. Provide sheet metal boxes.
- H. Wet and Damp Locations: Provide rigid steel and aluminum conduit. Thickwall nonmetallic conduit may be utilized where approved. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- I. Concealed Dry Locations: Provide intermediate metal conduit and electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- J. Exposed Dry Locations: Provide electrical metallic tubing except where subject to damage then provide rigid steel conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inch.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 25 00 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

1.9 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS**2.1 METAL CONDUIT**

- A. Manufacturers:
 - 1. Allied Tube and Conduit.
 - 2. Southwire Company.
 - 3. Wheatland Tube Company.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.

- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anamet Electrical.
 - 2. Electricflex Company.
 - 3. Southwire Company - Alfex.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: Interlocked steel construction.
- C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Anamet Electrical.
 - 2. Electricflex Company.
 - 3. Southwire Company - Alfex.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: Interlocked steel construction with PVC jacket.
- C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube and Conduit.
 - 2. Southwire Company.
 - 3. Wheatland Tube Company.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression type.

2.5 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Cantex.
 - 2. Carlon-Lamson and Sessions.
 - 3. Petroflex.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: NEMA TC 2; Schedule 40 and 80 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY**A. Manufacturers:**

1. Wiremold Co. Model V3000 Series.
2. Hubbell.
3. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.**C. Size:** 2 3/4" x 1 15/32" x length as required.**D. Finish:** Scratch resistant ivory finish.**E. Fittings, Boxes, and Extension Rings:** Furnish manufacturer's standard accessories; match finish on raceway.**2.7 WIREWAY****A. Manufacturers:**

1. Circle AW.
2. Hoffman.
3. Square D Company.
4. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: General purpose or as required to match environment installed**C. Knockouts:** Manufacturer's standard.**D. Size:** As indicated on Drawings.**E. Cover:** Hinged cover.**F. Fittings:** Lay-in type with removable side.**G. Finish:** Rust inhibiting primer coating with gray enamel finish.**2.8 OUTLET BOXES****A. Manufacturers:**

1. Appleton Electric.
2. OZ Gedney.
3. Racor.
4. Red Dot.
5. Thomas & Betts.
6. Substitutions: Section 01 25 00 - Product Requirements.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- E. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.9 PULL AND JUNCTION BOXES

- A. Manufacturers:
 - 1. Appleton Electric.
 - 2. OZ Gedney.
 - 3. Raco.
 - 4. Red Dot.
 - 5. Thomas & Betts.
 - 6. Substitutions: Section 01 25 00 - Product Requirements.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. Hinged Enclosures: As specified in Section 26 27 16.
- D. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:
 - 1. Material: Galvanized cast iron or Cast aluminum.
 - 2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".
- E. Fiberglass or Concrete composite Handholes: Die-molded, glass-fiber or concrete composite hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass-fiber or concrete composite, weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.

- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceway.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maximum Size Conduit in Slab above Grade: 1 inch. Do not cross conduits in slab.
- L. Maintain clearance between raceway and piping for maintenance purposes.
- M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows or hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.
- S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- T. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

- U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- X. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights required and as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
- C. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Section 01 77 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION 260533

SECTION 260923 - LIGHTING CONTROL DEVICES**PART 1 - GENERAL****1.1 WORK INCLUDED**

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.
- C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.2 EQUIPMENT QUALIFICATION

- A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.3 SYSTEM DESCRIPTION

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
- C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.4 SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
- B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature, which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.5 SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system. Unless specified otherwise, the contractor shall set all time delays to no less than 15 (fifteen) minutes.

PART 2 - PRODUCTS**2.1 LIGHTING CONTROL DEVICES**

- A. Manufacturers:
 - 1. AcuityControl – Sensor Switch.
 - 2. Substitutions: Section 01 25 00 - Product Requirements.
- B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors, which meet or exceed the specifications included herein.
- C. Wall switch sensors shall utilize Passive Infrared sensing technology only to detect motion.
- D. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
- E. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
- F. Wall switch products shall utilize Zero Crossing Circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- G. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

- H. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- I. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
- J. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
- K. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
- L. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
- M. Where specified, passive infrared and dual technology sensors shall offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.
- N. Dual technology sensors shall be corner or recessed mounted to avoid detection outside the controlled area when doors are left open. Sensors shall have Aauto on@ or Amanual on@ feature.
- O. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- P. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
- Q. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- R. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- S. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- T. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- U. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- V. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

- W. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- X. All sensors shall have UL rated, 94V-0 plastic enclosures.
- Y. For corrosive and wet locations, sensor electronics shall be coated for corrosion resistance.

2.2 CIRCUIT CONTROL HARDWARE - CU

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
- B. Relay Contacts shall have ratings of:
 - 13A - 120 VAC Tungsten
 - 20A - 120 VAC Ballast
 - 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms, which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room. Power/switch packs may or may not be indicated on the drawings. It shall be the contractor's responsibility to provide and install all power/switch packs required to make the system fully operational. Locations of power/switch packs may be determined in the field by the contractor unless specified otherwise, but must be readily accessible for future servicing. Usually, a minimum of one (1) power/switch pack is required per circuit and/or area of control. However, in some cases additional power/switch packs may be required. Contact manufacturer for final determination of power/switch packs required for this project.

- B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.
- D. Each room served by a ceiling mounted occupancy sensor, the contractor shall provide a toggle switch above the ceiling adjacent to the room lighting switches. The switch shall be normally turned "off". When turned "on" switch will bypass occupancy sensor.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes distribution and branch circuit panelboards, electronic grade branch circuit panelboards, and load centers.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 53 - Identification for Electrical Systems.
 - 3. Section 26 28 13 - Fuses.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 5. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 6. NEMA PB 1 - Panelboards.
 - 7. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- E. Underwriters Laboratories Inc.:
 - 1. UL 67 - Safety for Panelboards.
 - 2. UL 1283 - Electromagnetic Interference Filters.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Product Data: Submit catalog data showing specified features of standard products.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 MAINTENANCE MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance products.
- B. Furnish two of each panelboard key.

1.7 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)

- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS - EXISTING

- A. Add new thermal-magnetic circuit breaker or fusible switch type branch circuit devices to existing distribution panelboards as required.
- B. All new devices shall be of the same manufacturer, type and interrupting capacity as the original equipment.
- C. Provide new nameplates upon completion of all wiring. Refer to Section 16195.

2.2 BRANCH CIRCUIT PANELBOARDS - EXISTING

- A. Circuits to existing branch panelboards shall be connected to existing circuit breakers or plug fuses when available. Verify circuit numbers shown, provide new circuit breakers and/or rearrange existing circuit breakers as required.
- B. Where new circuit breakers are added to existing panelboards, rearrange or remove existing breakers as required to accommodate the new circuit breakers. Deliver unused/removed circuit breakers to Owner.
- C. All new circuit breakers installed in existing panelboards shall be of the same manufacturer, type, and interrupting capacity as the original equipment.
- D. Add plug fuses as required.
- E. Provide revised typewritten circuit directories upon completion of all wiring.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect abandoned panelboards and load centers. Remove and Install blank cover for abandoned panelboards and load centers.
- B. Maintain access to existing panelboard and load centers remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing panelboards and load centers to remain or to be reinstalled.

3.2 INSTALLATION

- A. Install panelboards and load centers in accordance with NEMA PB 1.1.
- B. Install panelboards and load centers plumb.
- C. Install recessed panelboards and load centers flush with wall finishes.
- D. Height: 6 feet to top of panelboard and load center; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- E. Install filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard and load center. Revise directory to reflect circuiting changes to balance phase loads.
- G. Install engraved plastic nameplates in accordance with Section 26 05 53.
- H. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.
- I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.4 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes wall switches; wall dimmers; receptacles; multi-outlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

1.6 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)

- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Model HBL 1221 Series.
 - 2. Leviton.
 - 3. Legrand - Pass & Seymour.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: NEMA WD 1, specification grade, AC only general-use snap switch.
- C. Body and Handle: Ivory plastic with toggle handle. Color selected by Architect.
- D. Indicator Light: Lighted handle type switch where indicated on drawings.
- E. Ratings: Match branch circuit and load characteristics.
- F. Provide similar construction three-way and four-way switches where indicated on drawings.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Model CR 5352 Series.
 - 2. Leviton.
 - 3. Legrand - Pass & Seymour.
 - 4. Substitutions: Section 01 25 00 - Product Requirements.
- B. Product Description: NEMA WD 1, General-duty general use receptacle.
- C. Device Body: Ivory plastic. Color selected by Architect.

- D. Configuration: NEMA WD 6, type as indicated on Drawings.
- E. Convenience Receptacle: Type 5-20.
- F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- G. Provide tamper resistant receptacles in areas where students are present.

2.3 WALL PLATES

- A. Decorative Cover Plate: In finished areas for switches and receptacles brushed 302 stainless steel. Provide oversized "jumbo plates" for devices on masonry walls, when required to conceal gaps.
- B. Surface raceway system plate: Utilize plate specifically designed for raceway system and device.
- C. Cover plate: In unfinished area provide cadmium plated steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on bottom.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

- H. Use jumbo size plates for outlets installed in masonry walls to conceal gaps.
- I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.
- B. Install wall switch 48 inches above finished floor.
- C. Install convenience receptacle 16 inches above finished floor.
- D. Install convenience receptacle 6 inches above back splash of counter.
- E. Install dimmer 48 inches above finished floor.
- F. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39.
- G. Coordinate installation of wiring devices with floor box service fittings.

3.5 FIELD QUALITY CONTROL

- A. Section 01 45 33 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Section 01 77 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes interior luminaires, lamps, drivers, and accessories.
- B. Related Sections:
 - 1. Section 23 37 00 - Air Outlets and Inlets: For interface with air handling fixtures.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 MAINTENANCE MATERIALS

- A. Section 01 77 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two of each ballast type.

1.7 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)

- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES

- A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Refer to Section 01 25 00 - Product Requirements for product options.

2.2 LED LUMINAIRES

- A. General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.
- B. Material and specifications for each luminaire are as follows:
 - 1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
 - 2. Each luminaire shall be rated for a minimum operational life of 50,000 hours at an average operating time of 12.0 hours per day. This life rating must be conducted 40C ambient temperature.
 - 3. The rated operating temperature range shall be -30°C to +40°C.
 - 4. Each luminaire is capable of operating above 100°F [37°C], but not expected to comply with photometric requirements at elevated temperatures.
 - 5. Photometry must be compliant with IESNA LM-79 and shall be conducted at 25°C ambient temperature.
 - 6. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

7. Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
8. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.

C. Drivers: Solid-State Type:

1. Drive and dimmer shall be designed, tested, and UL listed for specific lighting source/load type.
2. Driver output current shall not exceed 150% normal current.
3. Driver Input Watts: May not be reduced.
4. 0-10VDC Dimming.
5. Continuous, flicker-free dimming control from 100% to 1%.
6. Dimming Range: 100 to 1 percent of rated lamp lumens.
7. Compatibility of driver and LED light engine must be tested and ensured by driver manufacturer.
8. Control: Coordinate wiring from driver to control device to ensure that driver, controller, and connecting wiring are compatible.
9. Comply with NEMA SSL 7A-2013, entitled "Phase-Cut Dimming for Solid-State Lighting: Basic Compatibility."

D. Technical Requirements:

1. Electrical:
 - a. Power Consumption: Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.
 - b. Operation Voltage: The luminaire shall operate from a 60 HZ $\pm$ 3 HZ AC line over a voltage ranging from 108 VAC to 305 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
 - c. Power Factor: The luminaire shall have a power factor of 0.95 or greater.
 - d. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 10 percent.
 - e. Surge Suppression: The luminaire on-board circuitry shall include fused surge protection devices (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak currents up to 5 kA (minimum). SPD shall conform to UL 1449 depending of the components used in the design. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for category C (standard). The SPD shall fail in such a way as the Luminaire will no longer operate. The SPD shall be field replaceable.
 - f. Each Luminaire shall have integral UL Listed Class II power supplies. Class I power supplies will not be acceptable.
 - g. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.
 - h. RF Interference: LED Drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
 - i. Drivers shall have a Class A sound rating.

2. Photometric Requirements:

- a. Optical Assemblies: LEDs shall be provided with discreet over optical elements to provide proper distributions. All LEDs shall provide the same optical pattern such that catastrophic failures of individual LEDs will not constitute a loss in the distribution pattern.
- b. Illuminance: The illuminance shall not decrease by more than 30% over the expected operating life. The measurements shall be calibrated to standard photopic calibrations.
- c. Light Color/Quality: The luminaire shall have a correlated color temperature (CCT) range of 4,000K to 4,500K. The color rendition index (CRI) shall be 80 or greater. Binning of LEDs shall conform to ANSI/ G. NEMA SSL 3-2010.

3. Thermal Management:

- a. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
- b. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
- c. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
- d. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.
- e. The heat sink material shall be aluminum.

4. Physical and Mechanical Requirements

- a. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit.
- b. The assembly and manufacturing process for the LED luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.
- c. The electronics/power supply enclosure shall meet the requirements for NEMA/UL wet location.
- d. Door shall be hinged and secured to the housing in a manner to prevent its accidental opening.
- e. The circuit board and power supply shall be contained inside the luminaire. Electrolytic capacitors used in the power supplies shall be rated for -40°F to 220°F (-40°C to +105°C), long life (> 5000 hours), and operated at no more than 70% of their rated voltage, and 70% of rated current.

2.3 LED EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

- B. Internally Lighted Signs:

- 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

PART 3 - EXECUTION**3.1 EXISTING WORK**

- A. Disconnect and remove abandoned luminaires, lamps, and accessories.
- B. Extend existing interior luminaire installations using materials and methods compatible with existing installations, or as specified.
- C. Clean and repair existing interior luminaires to remain or to be reinstalled.

3.2 INSTALLATION

- A. Provide a coordinated layout of all natatorium lighting fixtures and submit to construction manager for review and approval prior to rough-in.
- B. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height. Provide additional structural support steel as required to support fixtures.
- C. Support luminaires independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan drawings.
- E. Install pendant and surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- F. Exposed Grid Ceilings: Support surface-mounted luminaires on grid ceiling directly from building structure. Install auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- G. Install recessed luminaires to permit removal from below.
- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Install clips to secure recessed grid-supported luminaires in place.
- J. Install wall-mounted luminaires at height as indicated on Drawings or as scheduled.
- K. Install accessories furnished with each luminaire.
- L. Connect grid mounted luminaires to branch circuit outlets provided under Section 26 05 33 using flexible conduit.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Interface with air handling accessories furnished and installed under Section 23 37 00.
- O. Ground and bond interior luminaires in accordance with Section 26 05 26.
- P. Install specified emergency lighting unit, exit sign, and luminaire.

3.3 FIELD QUALITY CONTROL

- A. Section 01 45 33 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

- A. Section 01 77 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust luminaires as indicated on Drawings.

3.5 CLEANING

- A. Section 01 77 00 - Execution and Closeout Requirements: Final cleaning.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

- A. Section 01 77 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Replace luminaires having failed L.E.D.s at substantial completion.
- C. Replace exit signs having failed L.E.D.s at substantial completion.

END OF SECTION 265100

SECTION 271343 - COMMUNICATION SERVICES CABLING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Patch panels.
2. Information outlets, jacks and faceplates.
3. Information cable.
4. Terminations.
5. Testing certification and documentation.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes.
2. Section 26 27 26 - Wiring Devices: Wall plates.

1.2 REFERENCES

- A. ANSI/TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
- B. ANSI/TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.
- C. ANSI/TIA/EIA-568-B.3 - Optical Fiber Cabling Standard.
- D. ANSI/TIA/EIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces.
- E. ANSI/TIA/EIA-606(A) - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
- F. ANSI/TIA/EIA-607(A) - Commercial Building Grounding and Bonding Requirements for Telecommunications.
- G. ANSI/TIA/EIA-526-14A - Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant.
- H. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- I. BICSI - Telecommunications Distribution Methods Manual.
- J. BICSI - Cabling Installation Manual.
- K. BICSI - LAN Design Manual.

1.3 QUALITY ASSURANCE

- A. Listing and Labeling: Provide telecommunication cables, termination hardware, devices and equipment that are listed and labeled by Underwriters Laboratories, Inc. (UL).
- B. NEC Compliance: Comply with requirements of NFPA 70, National Electrical Code, 1996 edition, as applicable to telecommunication cables.
- C. The telecommunication cable installer shall be licensed in the State of Illinois.
- D. The contractor shall be certified by the manufacturer of the structured cabling system to be installed and shall submit a copy of this certification in the form of an official authorization or certificate issued by that manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to Health/Life Safety Code for Public Schools.
- B. Conform to (IMC) International Mechanical Code. (2015)
- C. Conform to (IBC) International Building Code. (2015)
- D. Conform to (IFC) International Fire Code, excluding Chapter 4. (2015)
- E. Conform to State of Illinois Plumbing Code. (2014)
- F. Conform to Illinois Accessibility Code. (71 IL Adm. Code 400)
- G. Conform to (IECC) International Energy Conservation Code. (2015)
- H. Conform to (IFGC) International Fuel Gas Code. (2015)
- I. Conform to (IPMC) International Property Maintenance Code. (2015)
- J. Conform to Illinois State Fire Marshal's Boiler and Pressure Vessel Safety. (41 IL Adm. Code 120)
- K. Conform to (ICC) International Code Council Reference Standards. (2015)
- L. Conform to (NFPA) National Fire Protection Association 70 National Electrical Code. (2014)
- M. Products: Listed and classified by Underwriter's Laboratories, Inc. as suitable for the purpose specified and indicated.

1.5 SYSTEM COMPONENTS

- A. Service entrance from telecommunications utility company to remain.
- B. Backbone Pathway: Conform to ANSI/TIA/EIA 569-B using sleeves and methods as required.
- C. Horizontal Pathway: Conform to ANSI/TIA/EIA 569-B using sleeves and methods as required.

- D. Backbone Wiring: Complete from entrance equipment to each telecommunications closet.
- E. Horizontal Wiring: Complete from telecommunications closet to each outlet,

1.6 SYSTEM DESCRIPTION

- A. It is the intent of the Engineer to specify a Category 6A structured cabling system. The contractor shall provide this system based on Category 6A standards available at the time of installation. The Category 6A system will be capable of performing to 250 MHz and characterized out to 750 Mhz with documented balance characteristics. The user interface at the telecommunications outlet (TO) for Category 6A will be the 8-position modular jack. It is anticipated that this category will allow both UTP and ScTP cables.
- B. Contractor provides all raceways, outlet boxes, cables, termination hardware, patch panels, patch equipment, equipment racks, communication outlets, backboards, cable runway, J-hooks, all supporting hardware, telecommunications system grounding and bonding, testing, certifications and documentation, and identification as required for a complete information system as specified in this section and indicated on the drawings.
- C. All drop configurations are as indicated on drawings.
- D. All cabling in the building is to be routed to either the main distribution frame (MDF) or intermediate distribution frame (IDF) as indicated on the drawings. Voice/Data cabling is to be terminated on 48 port high density Category 6A patch panels installed in wall or floor mounted 19" racks. Provide racks with cable management sections and rack mounted surge protected power strips.
- E. Furnish and install backbone cabling and termination equipment between the wiring closets. Backbone media is to consist of one (1) 12-strand OM4 fiber optic cable. Route fiber optic cable in 1" inner-duct, plenum rated.
- F. All drops, patch panels and wiring blocks are to be labeled with machine printed label strips. No hand lettered labeling will be accepted.
- G. Front end data network computers and equipment will be furnished and installed by others.

1.7 SUBMITTALS

- A. Section 01 30 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog data for each termination device, cable, and outlet device.
- C. Test Reports: Indicate procedures and results for specified field testing and inspection.

1.8 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in installing products specified in this section with minimum three years documented experience and with service facilities within 50 miles of project.
- C. Testing Agency: Company or trained licensed contractor specializing in testing products specified in this section with minimum three years' experience.

1.10 PRE-INSTALLATION MEETING

- A. Convene minimum one week prior to commencing Work of this section.

1.11 EXTRA MATERIALS

- A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

1.12 COORDINATION

- A. Coordinate conduit raceway sizes, locations, penetrations, rated partitions, and requirements. Coordinate exact routing with work of other trades.

PART 2 - PRODUCTS**2.1 GENERAL SYSTEM REQUIREMENTS**

- A. Provide a complete tested and certified information system including but not limited to:
 - 1. Category 6A voice cable distribution.
 - 2. Category 6A data cable distribution.
 - 3. Termination hardware.
 - 4. Patch equipment.
 - 5. Supports and mounting hardware.
 - 6. Identification and labeling.
- B. Each information outlet shall be configured as indicated on the drawings.
- C. All telecommunications cabling work shall be in accordance with ANSI/TIA/EIA standards 568-B.2, 568-B.3 569-B, and 606-A. Grounding and bonding shall be in accordance with the National Electrical Code NFPA 72 2008.
- D. End-to-end Category 6A channel must be maintained, including patch panels, jacks and patch cords (of the same manufacturer) and the complete cable installation shall comply with ANSI/TIA/EIA 568-B.2

2.2 SUBMITTALS**A. Prior to Installation:**

1. Manufacturer cut sheets, product performance data, and installation instructions for each component including cables, termination hardware, patch panels, identification labels, racks, etc.
2. Contractor shall submit construction plans indicating drop locations, labeling, proposed routing, enlarged closet plans, and panel/wiring block usage details. These plans shall be generated on AutoCad 14 or later and submitted on CD-ROM. A hard copy set shall be stamped by a BICSI RCDD and submitted as part of the shop drawings.
3. Contractor will provide Panduit Certification certificates for 25 year warranty Compliance.

B. Project Closeout Submittals:

1. As-built record drawings including floor plans, telecommunication closet layouts, cable assignment records, cross-connect documentation, cable and termination labeling.
2. Updated pull schedules reflecting all changes made in the field.
3. Full documentation of the cable plant test results for Category 6A: Must conform to Test parameters specified for Level III testers as specified in ANSI/TIA/EIA-568-B.2.
 - a. End-to-end continuity.
 - b. End-to-end attenuation.
 - c. Requirements listed in 3.03 of this section.
4. Contractor to Provide 25 year system warranty.

2.3 INFORMATION OUTLETS, JACKS AND FACEPLATES, AND PATCH CORDS**A. Manufacturer:**

1. Panduit, current district standard.

B. Faceplates: Standard plate (white) or angled plate (white). Provide standard faceplates compatible with the surface metallic raceway system when applicable and match color.**C. Voice Jacks:** T568B, Category 6A, eight-position/eight-conductor, in color white.**D. Data Jacks:** T568B, Category 6A, eight-position/eight-conductor, in color blue.**E. Blank inserts for unused ports in outlets, snap-in blank module.****F. Other connection modules as specified on drawings.****2.4 PATCH EQUIPMENT AND COMMUNICATION CLOSET****A. Category 6A LAN Patch Equipment:**

1. Panduit, current district standard.

- a. Category 6A, 110 patch panel kit, T568B wired, mounted on EIA 19" rack. Include colored icons to match Voice and Data colored jacks.
- b. Provide adequate number of modular patch panels in rack to allow a minimum of eight (8) unused spare ports in each forty-eight (48) port panel for future use.
- c. Category 6A System Compatible Patch Cords: to be provided by owner.

B. Cable Runway and D-Rings:

1. Furnish and install cable runway, minimum 20" wide, within wiring closet above relay racks and backboards utilized to mount cable termination hardware. Secure cable runway to racks and wall with appropriate support kits.
2. Furnish and install cable management D-rings for routing cable bundles down walls and backboards.

2.5 VOICE AND DATA CABLES

- A. UL-Listed 100 ohm four (4) pair UP Category 6A, plenum rated cable for data and voice.
- B. 12-strand 50/125 micron OM4, tight buffered, plenum rated (OFNR), multimode fiber optic cable for data backbone.

2.6 J-HOOKS

- A. Provide manufacturer approved mounting hardware to accommodate installation.

2.7 TECHNOLOGY MATERIAL LIST (or current district standards)

Cable, TIA/EIA Category 6A Complaint UTP, CMP, 23 AWG/4 pair solid copper, jacket color blue

Faceplate, Wall Telephone Outlet, Stainless Steel

Faceplate, Wireless LAN & Door Outlet, Single Port

Faceplate, Clock/Speaker, Double Port Faceplate, Sloped Inserts

Faceplate, General Data, Four Port Faceplate, Sloped Inserts

RJ-45 Jack, ANSI/TIA-568-C.2 Complaint, CAT 6A

RJ-45 Patch Panel, 48 Port, 2 RU, ANSI/TIA-569-C.2-10 Complaint and UL Listed

Cable Management, Horizontal, 1 RU

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install pathways in accordance with ANSI/TIA/EIA 569-B.
- B. Install wire and cable in accordance with ANSI/TIA/EIA 568-B.2.
- C. Finish paint termination backboards with two coats of durable, fire retardant, white enamel in accordance with Section 09 90 00 prior to installation of cabling hardware or equipment.

- D. Install termination backboards and cabinets plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.
- E. Install polyethylene pulling string in each empty communications conduit over 10 feet in length or containing bends.
- F. Horizontal cable run above the suspended ceiling shall be installed in a neat and organized manner, straight and plumb and shall be when possible routed above accessible corridor areas. Cable drops to wall outlets shall be run in the conduit stub-ups.
- G. Horizontal cables shall be run above the suspended ceilings and shall be supported through J-hooks installed at a maximum spacing of 5 foot on-center. Coordinate cable installation with other ceiling installations including HVAC ducts, electrical fixtures and conduits, and sprinkler piping. Cable bundle droop shall not exceed 8" between supports.
- H. Voice and data cables shall be run in continuous uninterrupted sections from origin to termination with no splices or couplers.
- I. The Contractor shall provide conduit sleeves through all walls and floors to accommodate information cables. All sleeves shall be sized for 50 percent future growth. Fire seal sleeves using approved materials and methods once cables are pulled.
- J. Velcro style cable tie wraps shall be utilized within the wiring closet.
- K. Tie wraps utilized above ceilings shall be snug without deforming cable jacket.
- L. The length of each Horizontal cable run shall not exceed 295 feet. Horizontal cable is defined as that length of cable from the back of the workstation outlet to the back of the Patch Panel or connecting block in the telecommunications closet. Horizontal cable shall be a continuous run of cable with no splices, bridges, or other discontinuities.
- M. Maintain cable twist-rate at all termination points. The amount of cable untwist shall be no more than 1/2". Do not strip back the cable jacket any more than is necessary to terminate the individual conductors, 1 inch maximum.
- N. All 110 connections shall be installed using a single 110 punch down tool and all terminations shall be trimmed flush with connector blocks.
- O. Leave enough cable (approximately 1 foot at the workstation & 4 feet at the backboard or rack) to allow easy termination of the cable.
- P. Cables shall not be tie wrapped to electrical or gas conduit.
- Q. D-rings will be provided and mounted to route the horizontal cables at the backboard locations (& in chase locations as designated on the Drawings).
- R. No communication or data circuit shall be run in the same conduit or raceway with power conductor except where the raceway is separated by a divider.
- S. Cable routing shall avoid locations of high RFI/EMI radiation or adverse environmental conditions. Maintain minimum separations of: 6" from fluorescent light fixtures, 12" from open power conductors, 4'-0" from transformers and other high voltage devices.

- T. The voice/data cable plant shall be grounded and bonded. Provide a telecommunications main ground bus (TMBG) at main distribution frame (MDF) and a telecommunications ground bus (TGB) at intermediate distribution frame (IDF). Ground each rack to respective ground bus using #6 AWG copper conductor. Connect TGB's back to TMGB. Provide a complete and effectively grounded system.

3.2 IDENTIFICATION

- A. Provide identification labels at all cables, outlets and termination patch panels in accordance with the contract drawings and specifications.
- B. Cable labels shall be typed and covered with clear plastic laminate and shall be attached at 6" from the closet termination end and at 2"-4" from the outlet location end. Cable labels shall also be provided at the point where they entered as a bundle into the surface non-metallic raceway system.
- C. Provide identification (minimum 1/4" high lettering) at the racks to identify patch panels.
- D. Preprinted transparent adhesive labels shall be provided at all communication outlets identifying the outlet designation and the port assignments and shall be coordinated with the Owner's labeling scheme.
- E. Submit samples of all identification labels for Owners approval prior to installation.

3.3 TESTING AND CERTIFICATION

- A. Upon completion of the installation and termination of all communication cables, the cabling plant shall be end-to-end performance tested and certified for the specified cable classification categories and shall be performed in accordance with ANSI/TIA/EIA 568-B.2.
- B. All drops are to be tested with a hand held Level III cable tester generating a swept frequency, MHZ, min., signal. The test shall be a Channel Test. Test results shall indicate pass/fail of ANSI/TIA/EIA 568-B.2 limits for Channel Compliance as well as actual values, where applicable, for the following parameters as a minimum:
 - 1. Wire map.
 - 2. Length.
 - 3. Insertion loss
 - 4. Near End Cross Talk (NEXT) from both ends
 - 5. Delay and Delay Skew
 - 6. Power Sum Near End Cross Talk (PSNEXT)
 - 7. Equal Level Far End Cross Talk (ELFEXT)
 - 8. Power Sum Equal Level Far End Cross Talk (PSELFEXT)
 - 9. Return Loss
- C. Fiber Optic Cables: Each fiber strand shall be tested after final termination has been completed.
 - 1. End to End attenuation testing shall be performed using an optical power meter in both directions at the specified wavelengths for each fiber in the backbone system. Multimode fibers shall be tested at 850nm and 1300nm. The test results of each fiber shall indicate as a minimum:

- a. Cable Length
 - b. AdB@ loss
- 2. Acceptable connector loss: < 0.5 dB per mated pair; acceptable splice loss: < 0.2 dB; acceptable cable loss: per manufacturers calculated dB loss per 1000'.
- D. Test results shall be printed out and assembled in a binder for owner review.
- E. Provide certified records of all performance verification tests for Owner's record.
- 3.4 CABLE SCHEDULES
 - A. The installing contractor shall coordinate with school district representative the exact termination arrangement and identification/administration.

END OF SECTION 271343

SECTION 283100 - FIRE ALARM SYSTEM**PART 1 - GENERAL****1.1 SUMMARY**

- A. The system shall be in full compliance with National and Local Codes.
- B. The system shall include all required hardware, piping, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.
- C. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.
- D. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.
- E. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a "UL Listing Certificate" for the complete system.

1.2 DEFINITIONS

- A. ASME: American Society of Mechanical Engineers.
- B. FACP: Fire alarm control panel.
- C. FM: FM Global (Factory Mutual)
- D. Furnish: To supply the stated equipment or materials.
- E. Install: To set in position and connect or adjust for use.
- F. LED: Light-emitting diode.
- G. NCC: Network Command Center.
- H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
- I. NICET: National Institute for Certification in Engineering Technologies.
- J. Provide: To furnish and install the stated equipment or materials.
- K. UL: Underwriters Laboratories

1.3 SCOPE OF WORK

- A. The existing Notifier Onyx fire alarm control panel will remain. The existing system will be expanded to accommodate the new devices shown on the drawings for the renovation. The renovation will have addressable initiating and notification devices.
- B. This specification document provides the requirement for the installation, programming and configurations of a complete fire alarm system. This system shall include, but not be limited to, associated peripheral devices, batteries, wiring, conduit, and other relevant components and accessories required to furnish a complete and operation Life Safety System.

1.4 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

- A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Notifier.
- B. This provider shall employ factory trained and NICET Level II certified technicians, and shall maintain a service organization within 50 miles of this project location. The equipment and service provider shall have a minimum of 10 years' experience in the fire protective signaling systems industry.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.
 - 1. FM Global (Factory Mutual (FM)): FM Approval Guide.
 - 2. National Fire Protection Association (NFPA):
 - a. NFPA 70 National Electrical Code
 - b. NFPA 72 National Fire Alarm Code
 - c. NFPA 90A Standard for The Installation of Air Conditioning and Ventilating Systems
 - d. NFPA 101 Life Safety Code
 - 3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition:
 - a. UL Fire Protection Equipment Directory
 - b. UL Electrical Construction Materials Directory
 - c. UL 38 - Manually Actuated Signaling Boxes for Use with Fire Protection Signaling Systems
 - d. UL 228 - Door Holding Devices
 - e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
 - f. UL 268A - Smoke Detectors for Duct Application
 - g. UL 464 - Audible Signal Appliances
 - h. UL 497A - Secondary Protectors for Communications Circuits
 - i. UL 521 - Heat Detectors for Fire Protective Signaling Systems
 - j. UL 864 - Control Units for Fire Protective Signaling Systems
 - k. UL 1076 - Security
 - l. UL 1283 - Electromagnetic Interference Filters
 - m. UL 1449 - Transient Voltage Surge Suppressors

- n. UL 1971 - Signaling Devices for the Hearing Impaired
 - 4. Underwriters Laboratories Canada (ULC).
 - 5. International Code Council:
 - a. International Building Code
 - b. International Fire Code.
 - 6. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.
 - 7. California State Fire Marshal.
- B. Qualifications of Installers:
- 1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm and suppression systems of the same scope, type and design as specified.
 - 2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
 - 3. The contractor shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.
 - 4. The contractor shall be qualified by "UL" for certifying fire alarm systems. Upon completion of the installation the contractor shall certify the final system meets "UL" ongoing maintenance.
 - 5. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

1.6 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded microprocessor-based fire alarm components including initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Analog Smoke Sensors:
- 1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
 - 2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
 - 3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
 - 4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.

5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft. obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

1.7 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract Specification Sections.
 1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 2. Wiring diagrams from manufacturer.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.9 PROJECT CONDITIONS

- A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

1.10 WARRANTY

- A. Warranty Period: 2 years from date of Substantial Completion.

1.11 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.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original, unopened packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
- B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

PART 2 - PRODUCTS**2.1 ADDRESSABLE NON-ADDRESSABLE MANUAL PULL STATIONS**

- A. Description: Single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
- B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.2 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 - 5. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

6. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 7. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.
 8. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 9. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2.3 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.4 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required. There shall be the following types of modules:
1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone

- wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
- b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
2. Type 2: Line Powered Monitor Circuit Interface Module:
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two-wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 3. Type 3: Single Address Multi-Point Interface Modules:
 - a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
 4. Type 4: Line Powered Control Circuit Interface Module:
 - a. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
 5. Type 5: 4-20 mA Analog Monitor Circuit Interface Module:
 - a. This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.

- C. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.5 ADDRESSABLE NON-ADDRESSABLE ALARM NOTIFICATION APPLIANCES

- A. Horn: Horn shall be listed to UL 464. Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. Horn appliances shall have a High/Low Setting, programmable by channel from the addressable controller or by appliance from the host FACP. The horn shall have a minimum sound pressure level of 83 or 89 dBA for steady) or of 79 or 85 dBA for coded operation. The horn device shall consist of three pieces; appliance, cover and mounting plate. For ease of installation the mounting plate shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control panel. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.
- B. Visible/Only: Strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control panel. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control panel or by using a hardware selector on the appliance.
- C. Audible/Visible: Combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation audible/visible mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. The strobe shall provide multiple minimum flash intensities of 15cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control panel or using a hardware selector on the appliance. The Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. The horn shall have a minimum sound pressure level of 83 or 89 dBA for steady or 79 or 85 dBA for coded operation. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control panel. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliance shall be capable of two-wire synchronization with one of the following options:
 - 1. Synchronized Strobe with Horn on steady.
 - 2. Synchronized Strobe with Temporal Code Pattern on Horn.
 - 3. Synchronized Strobe with March Time cadence on Horn.
 - 4. Synchronized Strobe firing to NAC sync signal with Horn silenced.

- D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
- E. Accessories: The contractor shall furnish any necessary accessories.

2.6 NAC POWER EXTENDER

- A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B, Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
- B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNET Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.
- D. For IDNet connected NAC extender panels up to ten panels can be connected on a single IDNet channel.
- E. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.
- F. Alarms from the host fire alarm control panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

2.7 CO DETECTORS

- A. The CO detector (Part #4098-9771) shall be an addressable device that is compatible with fire alarm control panel. The CO detector shall have a sounder base that activates when CO is sensed.
- B. If the fire alarm system does not have an addressable CO detector, then a non-addressable CO detector can be used (Part #CO1224T) and an addressable monitor module (Part #4090-9001) will be used to monitor the CO detector.
- C. The CO detector will report to the fire alarm panel as supervisory condition when the CO detector is in alarm. Verify with the local AHJ to make sure how they want the CO detector to report to the fire alarm panel. CO detectors must be located within 20 feet of a carbon monoxide emitting device.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install Fire Alarm System devices as described herein and as shown on the plans. Include sufficient, manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Existing Fire Alarm Equipment shall be maintained fully operational until the new equipment has been tested and accepted.
- C. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.
- D. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
- E. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
- F. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- H. Install manual station with operating handle 48 inches above floor. Install wall mounted audible and visual notification appliances not less than 80 inches above floor to bottom of lens and not greater than 96 inches above floor to bottom of lens.
- I. Automatic Detector Installation: Conform to NFPA 72.

3.3 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
- B. Extension rings with blank covers shall be installed on junction boxes where required.
- C. Junction boxes served by concealed conduit shall be flush mounted.
- D. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

3.4 CONDUCTORS

- A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
- B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
- C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits; 18 AWG twisted shielded, telephone circuit; 18 AWG twisted shielded.
- D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

3.5 PREPARATION

- A. Coordinate work of this Section with other affected work.

3.6 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.
- E. Ethernet circuits shall be provided to the Fire Alarm Control Panel as shown on the plans. Where a Fire Alarm Ethernet LAN is specified only Agency Listed Ethernet hardware shall be installed.

3.7 DEVICES

- A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.
- B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.
- C. All devices and appliances shall be mounted to or in an approved electrical box.

3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Identification for Electrical Systems."
- B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
- C. A consistent color code for fire alarm system conductors throughout the installation.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. International Municipal Signal Association (IMSA) fire alarm certified.
 - 4. Certified by a state or local authority.
 - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning.
- D. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications:

- a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items.
 - b. Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
 - 2. Provide minimum 10 days' notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.
 - F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
 - G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.
- 3.10 CLEANING AND ADJUSTING
- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
 - B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

END OF SECTION 283100