PROJECT MANUAL
FOR

BLACK BOX THEATRE AHU AND PIPE INSULATION
JOLIET, ILLINOIS

OWNER

JOLIET JUNIOR COLLEGE
1215 HOUBOLT ROAD
JOLIET, ILLINOIS 60431

ARCHITECT / ENGINEER

KLUBER, INC.
41 W. BENTON STREET
AURORA, ILLINOIS 60506

DATE: AUGUST 12, 2025
PROJECT NO. 24-292-1574

BID & PERIMIT DOCUMENTS

SECTION 00 01 01
PROJECT TITLE PAGE

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FOR

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END OF DOCUMENT

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SEALS PAGE

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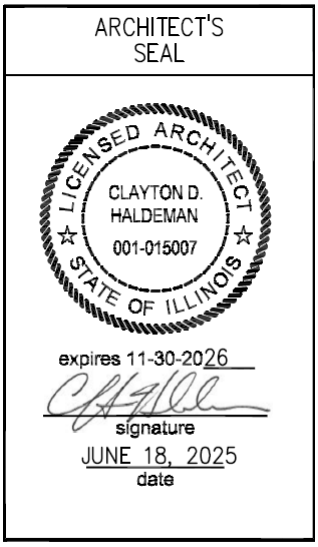
A. ARCHITECT

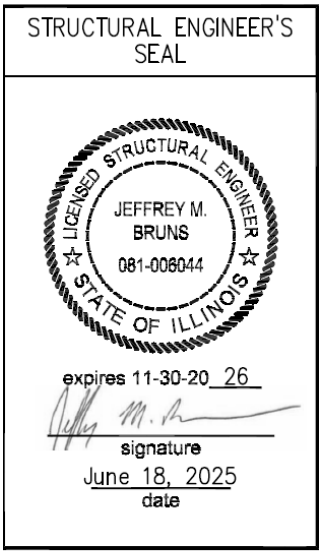
ARCHITECT'S SEAL



"G" SERIES, "A" SERIES

B. STRUCTURAL ENGINEER

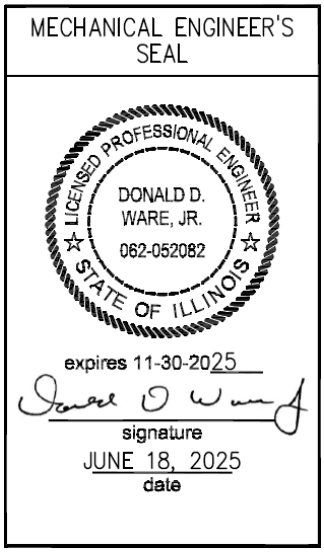
STRUCTURAL ENGINEER'S SEAL



"G" SERIES, "S" SERIES

C. MECHANICAL ENGINEER

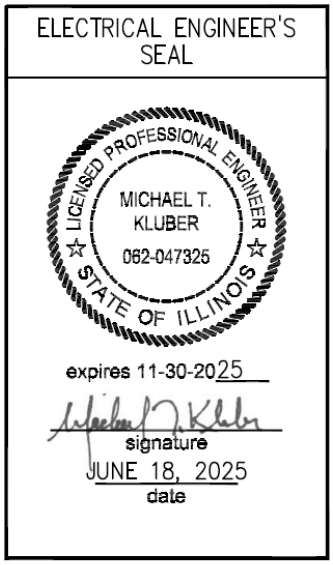
MECHANICAL ENGINEER'S SEAL



"G" SERIES, "M" SERIES, "F" SERIES

D. ELECTRICAL ENGINEER

ELECTRICAL ENGINEER'S SEAL



"G" SERIES, "E" SERIES

END OF DOCUMENT

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A420 SECOND FLOOR ARCHITECTURAL REFLECTED CEILING PLANS

STRUCTURAL

S310 SECOND FLOOR FRAMING PLAN

MECHANICAL

M210 GROUND FLOOR MECHANICAL DEMOLITION PLAN

M220 SECOND FLOOR MECHANICAL DEMOLITION PLAN

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END OF DOCUMENT

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Additional VAV Box: State the amount to be added to or deducted from the Base Bid to remove existing fan coil unit serving the corridor and provide an additional VAV box, piping, ductwork, etc. to serve the corridor as identified in the drawings.
   1. Base Bid Item: Existing fan coil unit to remain.
   2. Alternate Bid Item: Additional VAV box, piping, ductwork, etc. as identified in the drawings.

B. Alternate No. 2 - Pipe Insulation replacement: State the amount to be added to or deducted from the Base Bid to replace pipe insulation on HCS and HCR piping mains, fittings and valves in rooms identified on drawing M310A.
   1. Base Bid Item: Existing insulation on piping to remain.
   2. Alternate Bid Item: Remove and replace existing insulation on piping identified in the drawings.

C. Alternate No. 3 - Pipe Insulation replacement: State the amount to be added to or deducted from the Base Bid to replace pipe insulation on HCS and HCR piping runouts to terminal units (including piping, valves, and fittings) in rooms identified on drawing M310A.
   1. Base Bid Item: Existing insulation on piping to remain.
   2. Alternate Bid Item: Remove and replace existing insulation on piping identified in the drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals for review, information, and project closeout.

B. Architect/Engineer-provided CAD files.

C. Number of copies of Submittals.

D. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.

B. Submit to Architect/Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

3.02 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.

3.03 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at Project Closeout:
   1. Project record documents.
   2. Operation and maintenance data.

3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after Project completion.

3.04 ARCHITECT/ENGINEER-PROVIDED CAD FILES

A. After the execution of the Contract, Architect/Engineer will provide, free of charge, upon receipt of a properly completed and signed request utilizing “Electronic Data Transfer Consent Form” at the end of this Specification Section, CAD files depicting graphic information for the project as follows:
   1. Architectural Floor Plans: Column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, mechanical diffusers, plumbing fixtures, sprinkler heads (if depicted in Bid Documents) and lights.

B. Contractor acknowledges and accepts that the Architectural Floor Plans do not contain structural, mechanical, electrical, plumbing, fire protection and other building systems information depicted in the Bidding Documents. Examples of information not contained in these files include, but are not limited to, title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text or details. No other CAD files, data or information will be provided.

C. Only a request from The Contractor will be honored. Subcontractors must obtain the files from the Contractor.

D. In submitting a request, Contractor acknowledges that:
   1. Architect/Engineer bears no responsibility for the data or its transmission,
   2. Use of the data by the Contractor or his Subcontractors in no way relieves the Contractor of his obligations under the Contract,
   3. Contractor is solely liable for any and all claims arising from any and all products generated by the Contractor or its Subcontractors employing the data,
   4. Contractor and its Subcontractors have a limited, non-exclusive license to use the data solely in connection with the Work of the Project.
   5. Architect/Engineer retains all rights, including copyright, to the data.

3.05 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 01 78 00.

3.06 SUBMITTAL PROCEDURES

A. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Do not submit (Material) Safety Data Sheets for materials or products.

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

C. Transmit each Submittal with a copy of approved Submittal form.

D. Transmit each Submittal with AIA Form G810.

E. Sequentially number the transmittal form. Revise Submittals with original number and a sequential alphabetic suffix.

F. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

G. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

H. Schedule Submittals to expedite the Project, and coordinate submission of related items.

I. For each Submittal for review, allow 20 days excluding delivery time to and from the Contractor.

J. Clearly identify variations from the Contract Documents. Regardless of the type of variation, Contractor is solely responsible for errors in the field that arise from Submittal variations from the requirements of the Contract Documents if those variations were not expressly noted to specifically identify for and describe to the reviewer the nature of the variation from the Contract Documents.

K. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

L. Correlate submitted items with specified products; clearly indicate the specified product that corresponds to each submitted item.

M. When options or optional features available for a Product are indicated in a Submittal, and selections for those options/features are indicated in the Contract Documents, identify on the Submittal the selection indicated in the Contract Documents.

N. Provide space for Contractor and Architect/Engineer review stamps.

O. When revised for resubmission, using clouds, highlights or other means acceptable to the Architect, identify all changes made since previous submission. Resubmittals that do not clearly identify all changes may be delayed and/or returned to the Contractor unrevised.

P. The Contractor is entitled to 1 Resubmittal of any Shop Drawing, Product Data, or Closeout Submittal item rejected by the Architect or returned by the Architect for further action. Thereafter, the Contractor shall pay the cost of all further Architect's reviews of Shop Drawing, Product Data or Closeout Submittal, at a rate of $200.00/hour. Cost of such further reviews will be deducted from the Contract Sum by Change Order.

Q. Distribute reviewed Submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

R. Submittals not requested will not be recognized or processed.

S. Submittal reviews may be delayed and/or Submittals may be returned unrevised for any of the following reasons:
   1. Submittals submitted outside the scheduled dates of the Submittal Schedule.
   2. Submittals are incomplete or are missing information.
   3. Submittals are not submitted in accordance with procedures outlined in this Section (i.e. spec Section number not indicated, missing Contractor's review stamp, submitted items not correlated with specified products).

3.07 SUBMITTAL REVIEW

A. Submittals for Review: Architect/Engineer will review each submittal, and approve, or take other appropriate action.

B. Architect/Engineer's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

C. Architect/Engineer's actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Approved", or language with same legal meaning.
      b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
         1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
         2) Non-responsive resubmittals may be rejected.
   2. Not Authorizing fabrication, delivery, and installation:
      a. "Revise and Resubmit".
         1) Resubmit revised item, with review notations acknowledged and incorporated.
         2) Non-responsive resubmittals may be rejected.
      b. "Rejected".
         1) Submit item complying with requirements of Contract Documents.

END OF SECTION

Kluber
Architects + Engineers

www.kluberinc.com

ELECTRONIC DATA TRANSFER CONSENT FORM

Project Name: BLACK BOX THEATRE AHU AND PIPE INSULATION
1215 HOUBOLT ROAD
JOLIET, ILLINOIS 60431

Project No.: 24-292-1574

Owner: JOLIET JUNIOR COLLEGE

Your Work: _____

KLUBER, INC. (hereinafter referred to as "Kluber") an Illinois corporation, is providing electronic data to you solely at your request and for your convenience. By accepting and opening any of the electronic data files, you agree that Kluber bears no liability for the data or its transmission to you and that you are solely liable for any and all claims referring or relating to any and all products you, or your Subcontractors, may generate with the data.

You acknowledge that you have a limited non-exclusive license to use the information solely in connection with your work on the project captioned above, and that Kluber retains all rights, including copyright, to the data.

Acknowledged by: _____ _____
(Printed Name) (Signature)

Company: _____

Date: _____ Email: _____

Architectural Floor Plans are transmitted for the contractors' use as backgrounds for shop drawings and as-built drawings, and, as such, contain graphic information for column grid, walls, floors, stairs, doors, windows, room numbers, ceiling grid, lights, diffusers and sprinkler heads where indicated on Bid Documents. Plans do not contain title blocks, keynotes, schedules, mechanical ductwork and equipment, electrical device symbols, circuit numbers and home runs, plumbing equipment, piping runs and riser diagrams, and architectural/engineering text and details. Plans depict entire floors and are not formatted, partial plans as depicted in the Bidding Documents. Files are provided in R2013 .DWG format.)

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General.

B. Definitions.

C. Quality Assurance.

D. Regulatory Requirements.

1.02 RELATED SECTIONS

A. Section 01 42 00 - References.

1.03 GENERAL

A. Comply with all applicable laws, rules, regulations, codes and ordinances.

B. If the Contractor observes that the Contract Documents may be at variance with specified codes, notify the Architect/Engineer immediately. Architect/Engineer shall issue all changes in accordance with the General Conditions.

C. It shall not be the Contractor's primary responsibility to make certain that the Contract Documents are in accordance with all applicable laws, rules and regulations, however, when the Contractor performs work knowing or having reason to know that the work in question is contrary to applicable laws, rules, and regulations, and fails to notify the Architect/Engineer, the Contractor shall pay all costs arising therefrom.

1.04 DEFINITIONS

A. Definitions:
   1. Codes: Codes are statutory requirements, rules or regulations of governmental entities.
   2. Standards: Standards are requirements that have been established as accepted criteria, set general consent.

1.05 QUALITY ASSURANCE

A. The Architect/Engineer has designed the project to applicable code requirements and has copies of said codes available for the Contractor's inspection.

B. The Contractor shall:
   1. Ensure that copies of codes and standards referenced herein or specified in individual specifications sections are available to Contractor's personnel, agents, and Sub-Contractors.
   2. Ensure that Contractor's personnel, agents, and Sub-Contractors are familiar with the workmanship and requirements of applicable codes and standards.

1.06 REGULATORY REQUIREMENTS

A. Source and Requirements: Verify amendments with local code officials.
   1. Illinois Community College Board code requirements:
      a. ICC International Building Code, 2018 Edition.

b. ICC International Mechanical Code, 2018 Edition.
c. NFPA No. 101 - Life Safety Code, 2018 Edition.

2. State code requirements:
   a. Illinois Department of Public Health (IDPH):
      1) Illinois Plumbing Code (Illinois Administrative Code, Title 77, Chapter I, Subchapter r, Part 890).
   b. Illinois Environmental Protection Agency (IEPA):
      1) Air-Pollution Standards.
      2) Noise Pollution Standards.
      3) Water Pollution Standards.
      4) Public Water Supplies
      5) Solid Waste Standards.
   c. Illinois State Fire Marshal (OSFM):
      1) Boiler & Pressure Vessel Safety Code (Illinois Administrative Code, Title 44, Chapter I, Part 120).
      2) Illinois Rules & Regulations for Fire Prevention & Safety (Illinois Administrative Code 100).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 00
REFERENCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drawing symbols, abbreviations and acronyms.

B. Definitions of terms used throughout the Contract Documents.

C. Explanation of specification format and content.

D. Requirements relating to referenced standards.

E. Applicability of referenced standards.

F. List of industry organizations and certain of their respective documents.

1.02 DRAWING SYMBOLS AND CONVENTIONS

A. Abbreviations and graphic symbols are defined on the General Notes, Symbols & Abbreviations sheet of the drawings.

B. Generally, symbols used on the mechanical and electrical drawings conform to those recommended by ASHRAE, though, where appropriate, these symbols are supplemented by more specific symbols as recommended by ASME, ASPE, or the IEEE.

1.03 DEFINITIONS

A. Where the terms "indicated", "noted", "scheduled", "shown", or "specified" are used it is to help locate the reference; no limitation on location is intended except as specifically noted.

B. Where the terms "directed", "requested", "authorized", "approved", are used as in "directed by the Architect/Engineer", no implied meaning shall be construed to extend the Architect/Engineer's responsibilities into the Contractor's purview of construction supervision.

C. Where the term "approved" is used in conjunction with the Architect/Engineer's action on submittals, requests or applications it is limited to the duties of the Architect/Engineer as described in the Agreement, and the General and Supplemental Conditions of the Contract. Such use of the term "approval" shall not limit or release the Contractor from his responsibility to fulfill Contract requirements.

D. Where the term "regulations" is used it means all applicable statutes, laws, ordinances, and orders issued by authorities having jurisdiction, as well as construction industry standards, rules, or conventions that address performance of the Work.

E. Where the term "furnish" is used it means supply, deliver, and unload to the construction site ready for assembly and incorporation into the Work.

F. Where the term "install" is used it is meant to describe operations at the job site to include unloading, assembling, placing, anchoring, finishing, protecting, cleaning and all other similar operations required to fully incorporate an item into the Work.

G. Where the term “provide” is used it means “furnish and install” as defined above.

H. The "Project Site" is the space available to the Contractor for performance of construction activities. The Project Site may be for the exclusive use of the Contractor and his activities or may be used in conjunction with others with others performing other construction or related activities on the Project. The Extent of the Project Site is indicated on the Drawings.

1.04 SPECIFICATION FORMAT AND CONTENT

A. These Specifications are based on the Construction Specification Institute's 49 Division format and numbering system.

B. Language used in the Specifications and other Contract Documents is an abbreviated type. Implied words and meanings will be appropriately interpreted.

C. Requirements expressed in imperative and streamlined language are to be performed by the Contractor. At certain locations in the text, subjective language may be used to describe responsibilities that must be fulfilled indirectly by the Contractor or others.
   1. Whenever a colon (:) is used within a sentence or phrase, it shall be construed to mean the words "shall be".

D. Use of certain terms such as "carpentry" is not intended to imply that certain activities must be performed by accredited or unionized individuals of a corresponding generic name. The Specifications do, however, require that certain construction activities shall be performed by specialists who are recognized experts in the operations to be performed. Specialists shall be used for said activities, however the final responsibility for fulfilling the requirements of the Contract remains the Contractor's.

1.05 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue specified in this section, except where a specific date is established by applicable code.

C. Obtain copies of standards when required by the Contract Documents.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect/Engineer before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect/Engineer shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

1.06 APPLICABILITY OF INDUSTRY STANDARDS

A. Construction industry standards shall have the same force and effect as if bound or copied directly in the Contract Documents, except where more stringent requirements are specified. All such applicable standards are made a part of the Contract Documents by reference.

1. Where compliance with two or more standards are referenced and conflicting requirements for quality or quantities occur, comply with the more stringent requirements. Refer questions regarding apparently conflicting standards to the Architect for a decision before proceeding.
2. The standard of quality or quantity levels specified, shown, or referenced shall be the minimum to be provided or performed. Refer questions regarding standards of minimum quality or quantity to the Architect before proceeding.

1.07 CONSTRUCTION INDUSTRY ORGANIZATIONS AND DOCUMENTS

A. AA -- ALUMINUM ASSOCIATION, INC.

B. AABC -- ASSOCIATED AIR BALANCE COUNCIL

C. ACI -- AMERICAN CONCRETE INSTITUTE INTERNATIONAL

D. AISC -- AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

E. AISI -- AMERICAN IRON AND STEEL INSTITUTE

F. AMCA -- AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

G. ANSI -- AMERICAN NATIONAL STANDARDS INSTITUTE

H. ARI -- AIR-CONDITIONING AND REFRIGERATION INSTITUTE

I. ASHRAE -- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

J. ASME -- THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

K. ASTM -- AMERICAN SOCIETY FOR TESTING AND MATERIALS

L. AWS -- AMERICAN WELDING SOCIETY

M. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

N. FM -- FACTORY MUTUAL RESEARCH CORPORATION

O. ICC -- INTERNATIONAL CODE COUNCIL, INC.

P. IEEE -- INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS

Q. ISO -- INTERNATIONAL STANDARDS ORGANIZATION

R. MSS -- MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC.

S. NAAMM -- THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS

T. NAIMA -- NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION

U. NCMA -- NATIONAL CONCRETE MASONRY ASSOCIATION

V. NEBB -- NATIONAL ENVIRONMENTAL BALANCING BUREAU

W. NEMA -- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

X. NFPA -- NATIONAL FIRE PROTECTION ASSOCIATION

Y. SMACNA -- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.

Z. SSPC -- THE SOCIETY FOR PROTECTIVE COATINGS

AA. SWRI -- SEALANT, WATERPROOFING AND RESTORATION INSTITUTE

BB. UL -- UNDERWRITERS LABORATORIES INC.

CC. USG -- UNITED STATES GYPSUM

1. USG (HB) - Gypsum Construction Handbook; Seventh Edition.

1.08 UNITED STATES GOVERNMENT AND RELATED AGENCIES/DOCUMENTS

A. CFR -- CODE OF FEDERAL REGULATIONS

B. CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

C. EPA -- ENVIRONMENTAL PROTECTION AGENCY

D. FS -- FEDERAL SPECIFICATIONS AND STANDARDS (General Services Administration)

E. GSA -- U.S. GENERAL SERVICES ADMINISTRATION

1.09 STATE GOVERNMENT AND RELATED AGENCIES/DOCUMENTS

A. CDB -- ILLINOIS CAPITAL DEVELOPMENT BOARD

B. IDOL -- ILLINOIS DEPARTMENT OF LABOR

C. IDPH -- ILLINOIS DEPARTMENT OF PUBLIC HEALTH

D. IEPA -- ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

E. OSFM -- OFFICE OF THE ILLINOIS STATE FIRE MARSHAL.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Existing facilities may be used.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:
   1. One (1) mobile cellular telephone for each of Contractor's and any Subcontractor's field personnel.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
   1. Use of existing facilities located at Project Site is permitted.

B. Maintain daily in clean and sanitary condition.

C. At end of construction, return facilities to same or better condition as originally found.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide protection for plants and turf not designated for removal. Replace damaged plants and turf.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.07 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. All on-site personnel of Contractor, Subcontractors and Suppliers must pass a background check, performed by the Owner or by an outside agency of the Owner's choosing.
   1. At least 7 days prior to a Contractor, Subcontractor or Supplier employee being present on the jobsite, provide Owner with employee's full name and date of birth, to allow the Owner to conduct a background check on the individual.
   2. Prior to allowing employee to come to the jobsite, await Owner's receipt of background check results and written confirmation from Owner that employee is permitted to be on site.

1.08 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.09 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.10 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Designed, manufactured, and tested in accordance with industry standards.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site and place in location directed by Owner's representative; obtain Owner's signature on receipt for delivery prior to final payment. Submit signed receipts with Closeout Submittals.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. Substitutions Prior To Bid Opening: Architect/Engineer will consider a written request for substitution provided that such request is received at least seven (7) days prior to the Bid opening date. Requests received after that time will not be considered.
   1. If a request is approved, the Architect/Engineer will issue and appropriate addendum not less than three (3) days prior to the Bid opening date.

B. Substitutions After Notice of Award: Architect/Engineer will consider a request for substitution only under one or more of the following conditions:
   1. Substitution is required for compliance with final interpretation of code requirements or insurance regulations.
   2. Specified product is not available through no fault of the Contractor.
   3. Specified product is not compatible with other specified materials/equipment.
   4. Manufacturer will not certify or warranty specified product as required.

C. Document each request utilizing Substitution Request Form following this section with complete data substantiating compliance of proposed substitution with Contract Documents. Incomplete requests will not be considered. Submit a separate Substitution Request Form and accompanying documentation for each proposed substitution.

D. Provide the following minimum documentation with each Substitution Request Form:
   1. Product identification, manufacturer, product data including dimensions and weight, performance and installation instructions.
   2. Side-by-side itemized comparison of proposed substitution with specified product.
   3. Coordination information including other modifications required as a result of proposed substitution.
   4. Cost information including the effect of the proposed substitution on the Contract Sum.

E. Sign and date the Substitution Request Form.

F. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction over the Project.

G. Architect/Engineer will notify submitter in writing of decision to accept or reject request.

H. Substitutions of products or product characteristics/components/options/accessories will not be considered when they are indicated or implied on Contractor's submittals, without separate written request, or when acceptance will require revision to the Contract Documents, whether rejection of said substitutions is expressly identified by Architect/Engineer on Contractor's submittals or not.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

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SUBSTITUTION REQUEST FORM

PROJECT: BLACK BOX THEATRE AHU AND PIPE INSULATION

SPECIFIED ITEM: _____

Specification Section	Page	Paragraph	Description
_____	_____	_____	_____

The undersigned requests consideration of the following:

PROPOSED SUBSTITUTION: _____

_____

Attached data includes project description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

_____
Printed Name

_____
Signature Date

_____
Firm

_____
Telephone

_____
Email

Attachments (list):

For Use By The Architect/Engineer:

☐ Accepted ☐ Accepted As Noted

☐ Not Accepted ☐ Received Too Late

By: _____

Date: _____

Remarks:

Corporate Office
41 W. Benton Street
Aurora, Illinois 60506
630.406.1213

Bloomington Office
2401 E. Washington Street, Suite 200-B2
Bloomington, Illinois 61704
309.430.6460

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties.

B. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

1.04 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

C. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

D. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

E. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Coordinate completion and clean-up of work of separate sections.

F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS - NOT USED

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect/Engineer before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on Drawings.
   2. Relocate items indicated on Drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC and Electrical): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.05 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.07 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.08 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.10 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean filters of operating equipment.

E. Clean site; sweep paved areas, rake clean landscaped surfaces.

F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. See Section 01 77 00 for additional requirements.

B. Make submittals that are required by governing or other authorities.

C. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

D. Notify Architect/Engineer when work is considered ready for Architect/Engineer's Substantial Completion inspection.

E. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect/Engineer's Substantial Completion inspection.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect/Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect/Engineer.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Notify Architect/Engineer when work is considered finally complete and ready for Architect/Engineer's Substantial Completion final inspection.

I. Complete items of work determined by Architect/Engineer listed in executed Certificate of Substantial Completion.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Substantial Completion Procedures.

B. Final Completion Procedures.

1.02 RELATED REQUIREMENTS:

A. Section 01 78 00 - Closeout Submittals.

1.03 SUBSTANTIAL COMPLETION PROCEDURES

A. Substantial Completion Procedures:
   1. When the Work or a portion of the Work is considered to be substantially complete, the Contractor inspects the project and prepares a comprehensive list of outstanding items to be completed or corrected, Initial Punch List.
   2. Contractor submits notice of Substantial Completion.
   3. Contractor completes items on the Initial Punch List.
   4. Architect/Engineer inspects the project to verify substantial completion and prepares a Final Punch List.
   5. Architect/Engineer prepares Certificate of Substantial Completion, acceptance is required by Owner and Contractor.

1.04 FINAL COMPLETION PROCEDURES

A. Final Completion Procedures:
   1. When items on Initial and Final Punch Lists are complete, the Contractor submits notice of final completion and final application for payment.
   2. Contractor submits Final Closeout Submittals as specified in Section 01 78 00.
   3. Architect inspects project and verifies the Work is acceptable and conforms with the Contract Documents.
   4. Architect processes final application for payment and closeout submittals.

1.05 CORRECTION PERIOD

A. Correction Period commences on the date of Substantial Completion and expires one year from that date.

B. Owner: document non-conforming or defective work over course of Correction Period. Notify Contractor in writing of nonconforming or defective work. Copy Architect/Engineer.
   1. Life safety issues requiring immediate corrective work: Contact Contractor for action.

PART 2 PRODUCTS - NOT USED.

PART 3 EXECUTION - NOT USED.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect/Engineer.

B. Operation and Maintenance Data:
   1. Submit preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content as required prior to final submission.
   4. Submit revised final documents in final in PDF file format on USB flash drive form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings : Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into PDF file "manual" for Owner's personnel use, with data arranged in the same sequence as, and bookmarked by, the specification sections.
   1. Media: USB flash drive of capacity sufficient to store entire PDF file, fragmented.

2. Attach a tag or label flash drive with Project name, date, and the title "O&M Manual".

B. Where systems involve more than one specification section, provide separate bookmark for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Cover Page: Populate the first page of the PDF file with: printed title "OPERATION AND MAINTENANCE MANUAL; identify title of Project; identify subject matter of contents.

F. Project Directory: Beginning on the second page of the PDF file; provide Title and address of Project; names, addresses, and telephone numbers of Architect/Engineer, Consultants, Contractor and subcontractors, with names of responsible parties.

G. Table of Contents: List every item identified by a bookmark, using the same identification as in the title of the bookmark.

H. Bookmarks: Bookmark each separate product and system; identify the contents in the title of the bookmark; on the bookmarked page provide a description of product and major component parts of equipment.

I. Content: Manufacturer's printed data, legibly scanned, in color where applicable, at 300 dpi resolution.

J. Drawings: Legibly scanned, in color where applicable, at 300 dpi resolution; PDF file page size to match native sheet size of original drawing.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include color, 300 dpi resolution scans of each in Operation and Maintenance Manual PDF file, bookmarked indexed separately in Table of Contents.

F. Manual: Bind original copies of warranties and bonds in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Electrical systems and equipment.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect/Engineer for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: USB Flash Drive.
   2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building and site elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

B. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 DEFINITIONS

A. Where the term "demolish" or "remove" is used it shall be construed to mean remove and legally dispose of off site.

B. Where the term "refurbish" is used it shall be construed to mean refinish, repair and otherwise restore to like-new condition.

C. Where the term "relocate" is used it shall be construed to mean disconnect from existing utilities, move to new location and reinstall and reconnect to utilities.

D. Where the terms "temporarily remove" or "salvage" are used they shall be construed to mean carefully remove so as to prevent damage.
   1. If the item is to be saved for reinstallation or relocation as part of the Work, these terms shall also be construed to mean clean, adjust, lubricate and otherwise restore to best possible condition without repair or refinishing. Otherwise, they shall mean clean item surfaces and turn over to the Owner for storage and possible future use.

E. Where the phrase "salvage in place" is used it shall be construed to mean protect in place so as to prevent damage while adjacent elements are demolished, restore to best possible condition without repair or refinishing, and modify as necessary to properly incorporate and integrate with new Work.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Extent of demolition work is indicated on the Drawings.

B. Remove items indicated, for salvage and relocation.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 01 70 00.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of elements to be removed; do not allow worker or public access within range of potential collapse of unstable elements.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent elements and occupants.
   8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent elements.
   3. Stop work immediately if adjacent elements appear to be in danger.

F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. Hazardous Materials:
   1. If hazardous materials are discovered during removal operations, stop work and notify Architect/Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect/Engineer before disturbing existing installation.

3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from areas that remain occupied.

C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

D. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC and Electrical): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete Reinforcing.

C. Floors and slabs on grade.

D. Miscellaneous concrete elements, including equipment pads.

E. Concrete curing.

1.02 REFERENCE STANDARDS

A. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

B. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

C. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

G. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

H. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

I. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

K. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

L. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

M. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2024.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. Anchoring epoxy and expansion anchors.

C. Mix Designs: Submit 15 days prior to start of work.
   1. Submit for each type of concrete specified.
   2. Include back-up test data.
   3. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
   4. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports: Submit report for each test or series of tests specified.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C.

D. Ground Granulated Blast Furnace Slag: ASTM C989/C989M.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Accelerating Admixture: ASTM C494/C494M Type C.

H. Retarding Admixture: ASTM C494/C494M Type B.

I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

A. Anchoring Epoxy: Refer to drawings. Acceptable manufacturer's include...
   1. Hilti: HIT-RE500-SD injection anchoring system.
   2. Simpson Strong-Tie: SET-XP injection anchoring adhesive system.
   3. Powers Fasteners: PE 1000+ injection adhesive anchoring system.

B. Expansion Anchors: Refer to drawings. Acceptable manufacturer's include...
   1. Hilti: Kwik Bolt 3 expansion anchor.
   2. Simpson Strong-Tie: Strong-Bolt 2 wedge anchor.

2.06 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

B. Water: Potable, not detrimental to concrete.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended by manufacturer. Submit to Architect for review and approval.

D. Normal Weight Concrete: Type "A".
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Water-Cement Ratio: Maximum 48 percent by weight.
   4. Total Air Content: 2 percent, determined in accordance with ASTM C 173/C 173M.
   5. Maximum Slump: 4 inches.
   6. Maximum Aggregate Size: 3/4 inch.
   7. MVRA Admixture.

2.08 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and secure in place using approved epoxy.

D. Set steel pipe bollards plumb.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Notify Architect/Engineer not less than 24 hours prior to commencement of placement operations.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement and embedded parts will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

C. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
   1. Provide light broom finish on exterior flat work.
   2. Provide 3/4" radiused edge on exposed slab edges, unless otherwise noted.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.08 FIELD QUALITY CONTROL

A. Provide free access to concrete operations at project site and cooperate with appointed firm.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect/Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.11 SCHEDULE - CONCRETE TYPES AND FINISHES

Location	Mix Type	Concrete Finish
Equipment Pad: Interior	A	Sides: Smooth formed Top: Non-slip

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Mortar.

C. Reinforcement and anchorage.

1.02 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.

F. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.

G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

J. ASTM C212 - Standard Specification for Structural Clay Facing Tile; 2022.

K. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.

L. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

M. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

N. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2022.

O. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2023b.

P. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

R. Standard Practice for Bracing Masonry Walls Under Construction - Mason Contractors Association of America.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Source Limitations For Masonry Units: Obtain masonry units of a uniform texture, color and blend (within the range acceptable for each characteristic) through one source from a single manufacturer for each product required.

C. Source Limitations For Mortar Materials: Obtain mortar components of a uniform quality from one manufacturer for each component and from one source or producer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Deliver packaged materials in manufacturers' original containers, with labels and markings intact and legible.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
   2. All Units: ASTM C90, medium or lightweight, at contractor's discretion. Unit Compressive Strength: 2150 psi.
      a. Hollow block.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
   3. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at time of manufacture.
      a. Performance of Units with Integral Water Repellent:

1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
   a) No water visible on back of wall above flashing at the end of 24 hours.
   b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
   c) No more than 25 percent of wall area above flashing visibly damp at end of test.
2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.

b. Use only in combination with mortar that also has integral water repellent admixture.
c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Hydrated Lime: ASTM C207, Type S.
   2. Mortar Aggregate: ASTM C144.

B. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

C. Water: Clean and potable.

D. Admixtures:
   1. Air-entraining admixtures or cementitious materials containing air-entraining admixtures are not permitted in mortar.
   2. Anti-freeze compounds or other substances used to lower the freezing point of mortar or grout are not permitted.
   3. Admixtures containing calcium chloride are not permitted.

E. Accelerating Admixture: Nonchloride type for use in cold weather.

F. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

2.03 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com.
   2. Hohmann & Barnard, Inc: www.h-b.com.
   3. WIRE-BONDwww.wirebond.com/#sle.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
   1. CMU backup:12 ga. channel slots, 8 inches long, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

2.04 MORTAR MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Exterior, loadbearing masonry: Type N.
   2. Exterior, non-loadbearing masonry: Type N.

B. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Temporary Bracing: Provide temporary support and bracing as required for stability, safety and proper performance of masonry during installation of masonry work. Maintain in place until connections and structural elements providing permanent bracing are fully erected and installed and have achieved full strength.

C. Prevent mortar and soil from staining the face of masonry to be left exposed to view, whether scheduled to be painted or not. Immediately remove grout, mortar and soil that come in contact with such masonry.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave; provide other joint types where indicated on the Drawings or in this Section.

3.05 PLACING AND BONDING

A. Combine concrete masonry units and mortar to achieve a net masonry prism strength (f'm) of 1500 psi.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar, mortar droppings and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where EIFS vapor barrier is to be applied.

I. Isolate masonry partitions from vertical structural framing members with a control joint.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

K. Build cavity and multi-wythe walls to full thickness shown (adjust cavity space).

L. Build and verify dimensions for chases and pockets for built-in items according to trade contractor and equipment requirements. Notify Architect of any discrepancies between requirements and drawings.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place continuous joint reinforcement in first and second joint below top of infills.

C. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 16 inches vertically.

D. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.07 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.08 CUTTING AND FITTING

A. Cut and fit for pipes, ducts, sleeves, ducts, and ducts. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain Architect/Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.09 CLEANING

A. Remove excess mortar, mortar smears and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.10 PROTECTION

A. Provide temporary support and bracing as required for stability, safety and proper performance of erected masonry work until connections and structural elements providing permanent bracing are fully erected and installed and have achieved full strength.

B. Prevent soil and materials from other trades from staining the face of masonry to be left exposed to view, whether scheduled to be painted or not. Immediately remove soil and other foreign materials that come in contact with such masonry.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items, including: Lintels.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

E. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

G. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. Anchoring epoxy and expansion/wedge anchors.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Fabricator: Company holding the contract for the work of this Section must be a fabricator, not a broker, and must self-perform all the work of this Section.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel Sections: ASTM A36/A36M.

C. Plates: ASTM A283/A283M.

D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

E. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction; compatible with scheduled painted finish, coating or fireproofing specified in related Sections.

2.02 ACCESSORY MATERIALS

A. Anchoring Epoxy: Refer to drawings. Acceptable manufacturer's include...
   1. Hilti: HIT-HY-150 fast curing injection system.
   2. Simpson Strong-Tie: SET-XP high-strength anchoring adhesive.
   3. Powers Fasteners: Pure110+ epoxy injection adhesive anchoring system.

B. Expansion Anchors: Refer to drawings. Acceptable manufacturer's include...
   1. Hilti: Kwik Bolt 3 expansion anchor.
   2. Simpson Strong-Tie: Strong-Bolt 2 wedge anchor.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FINISHES - STEEL

A. Prime paint all steel items unless scheduled otherwise at the end of this section.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

A. Install items level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Weld components where required on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.04 TOLERANCES

A. Maximum Offset From True Alignment: 1/4 inch.

B. Maximum Out-of-Position: 1/4 inch.

3.05 SCHEDULE

A. Exterior Locations and Interior Corrosive Environments Finish
   1. Lintels Galvanized

B. Interior Locations (Non-Corrosive Environments) Finish
   1. Lintels Primed

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in interior wall construction.

1.02 RELATED REQUIREMENTS

A. Section 07 24 00 - Exterior Insulation and Finish Systems: Foam board insulation as part of EIFS.

1.03 REFERENCE STANDARDS

A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.02 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
   4. Formaldehyde Content: Zero.
   5. Thermal Resistance: R-value as indicated on the Drawings.
   6. Thickness: Sized to fill cavity, unless specific thickness is annotated on the Drawings.
   7. Facing: Unfaced.
   8. Products:

a. CertainTeed Corporation: www.certainteed.com.
b. Johns Manville: www.jm.com.
c. Owens Corning Corporation: www.ocbuildingspec.com.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Provide foil facing on one side, at locations indicated on drawings.
4. Thermal Resistance: R-value as indicated on the Drawings.
5. Thickness: Sized to fill cavity, unless a specific thickness is annotated on the Drawings.
6. Products:
a. Johns Manville: www.jm.com.
b. ROCKWOOL (ROXUL, Inc)COMFORTBATT: www.rockwool.com.
c. Thermafiber, Inc; SAFB: www.thermafiber.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating, Class PB.

B. Drainage and water-resistive barriers behind insulation board.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

D. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).

E. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2022.

F. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2015 (Reapproved 2020).

G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

J. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2018.

K. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2022.

L. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

M. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2021.

N. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009.

O. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2015, with Editorial Revision (2022).

P. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2023, with Errata.

Q. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.

R. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.

D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.

F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

1.05 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.

B. Installer Qualifications: Company specializing in the type of work specified and with at least ten years of experience.

1.06 MOCK-UPS

A. Construct mock-up of typical EIFS application on specified substrate, size as indicated on drawings, and including flashings, joints, and edge conditions.

B. Locate mock-up as indicated on drawings.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.
   1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
   2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.

3. Protect insulation materials from exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Insulation and Finish Systems Manufacturers:
   1. Dryvit Systems, Inc; Dryvit Outsulation EIFS, Class PB: www.dryvit.com.
   2. Master Wall, Inc; Rollershield Drainage CIFS - Continuously Insulated Finish System with Drainage and Air/Water Barrier: www.masterwall.com.
   3. Sika Corporation; Senergy Channeled Adhesive CI (Continuous Insulation) Design Wall System: www.senergy-mbcc.sika.com/en.
   4. Sto Corp; StoTherm ci: www.stocorp.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on flat-backed insulation board adhesive-applied directly to water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.

B. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.
   2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
   3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

C. Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi, when tested in accordance with ASTM C297/C297M.

D. Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C297/C297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi in all samples.

E. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

F. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

G. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.

H. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

I. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

J. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

K. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

L. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

M. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:
   1. Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.

2.03 MATERIALS

A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
   1. Color and Texture: Match existing.

B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB.

C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.

D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.

1. Board Size: 24 by 48 inches.
2. Board Size Tolerance: Plus/minus 1/16 inch from square and dimension.
3. Board Thickness: As indicated on the Drawings.
4. Board Edges: Square.
5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.

E. Water-Resistive Barrier Coating: Fluid-applied air and water barrier membrane; applied to sheathing; furnished or approved by EIFS manufacturer.

2.04 ACCESSORIES

A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.

B. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including drainage accessories.

C. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.02 PREPARATION

A. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

3.03 INSTALLATION - GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.
1. Where different requirements appear in either document, comply with the most stringent.
2. Neither of these documents supersedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

3.04 INSTALLATION - WATER-RESISTIVE BARRIER

A. Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.

B. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.

C. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.

D. At moving expansion joints, apply flexible flashing or flashing tape across and recessed into joint with U-loop forming continuous barrier but allowing movement.

E. Lap flexible flashing or flashing tape at least 2 inches on each side of joint or transition.

3.05 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Prior to installation of boards, install starter track and other trim level and plumb and securely fastened. Install only in full lengths, to minimize moisture intrusion; cut horizontal trim tight to vertical trim.

C. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

D. On wall surfaces, install boards horizontally.

E. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

F. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.

G. Rasp irregularities off surface of installed insulation board.

H. Adhesive Attachment: Use method required by manufacturer to achieve drainage efficiency specified; do not close up drainage channels when placing insulation board.

3.06 INSTALLATION - CLASS PB FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
   1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
   2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. At locations indicated, install second layer of reinforcing mesh embedded in second coat of base coating, tightly butting ends and edges of mesh.

C. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

D. Finish Coat Thickness: As recommended by manufacturer.

E. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

3.07 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.08 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

D. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

F. SWRI (VAL) - SWR Institute Validated Products Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Backing material recommended by sealant manufacturer.
   4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   5. Substrates the product should not be used on.
   6. Substrates for which use of primer is required.
   7. Substrates for which laboratory adhesion and/or compatibility testing is required.
   8. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   9. Sample product warranty.
   10. Certification by manufacturer indicating that product complies with specification requirements.
   11. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect/Engineer and submit at least two physical samples for verification of color of each required sealant.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

G. Installer's qualification statement.

H. Executed warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience.

C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
   1. Dow Corning Corporation: www.dowcorning.com/construction.
   2. Hilti, Inc: www.us.hilti.com.
   3. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us.
   4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
   5. Pecora Corporation: www.pecora.com.
   6. Sika Corporation: www.usa-sika.com.
   7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
   8. W.R. Meadows, Inc: www.wrmeadows.com.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints:
      a. Seal open joints except open joints indicated on drawings as not sealed.
   2. Interior Joints:
      a. Seal open joints except specific open joints indicated on drawings as not sealed.
   3. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Weep holes in curtain wall, storefront and window systems.
      c. Joints indicated to be covered with expansion joint cover assemblies.
      d. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
      e. Joints where sealant installation is specified in other sections.
      f. Joints between suspended ceilings and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

C. Interior Joints: Use non-sag acrylic-urethane sealant, unless otherwise indicated.
   1. Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.

D. Interior Wet Areas: Animal barns; fixtures in wet areas include duct penetrations and flashings.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Color: To be selected by Architect/Engineer from manufacturer's standard range.
   2. Cure Type: Single-component, neutral moisture curing.
   3. Products:
      a. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html.
      b. Sika Corporation; Sikasil WS-290: www.usa-sika.com.
      c. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com.
      d. Tremco Commercial Sealants & Waterproofing; Tremsil 200: www.tremcosealants.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
   1. Products:
      a. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.
   1. Products:
      a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Sealant Backing Rod, Closed-Cell Type:
   1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
   2. Size: 25 to 50 percent larger in diameter than joint width.

B. Sealant Backing Rod, Bi-Cellular Type:
   1. Cylindrical flexible sealant backings complying with ASTM C1330 Type B.
   2. Size: 25 to 50 percent larger in diameter than joint width.

C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

D. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

E. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

F. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 09 90 00 - Painting and Coating: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

J. ASTM E413 - Classification for Rating Sound Insulation; 2022.

K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
   3. Republic Doors, an Allegion brand: www.republicdoor.com.
   4. Steelcraft, an Allegion brand: www.allegion.com.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Door Edge Profile: Manufacturers standard for application indicated.
   4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
   5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

2.03 HOLLOW METAL DOORS

A. Sound-Rated Interior Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 39, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.
4. Door Thickness: As required to meet acoustic requirements indicated.
5. Door Face Sheets: Flush.
6. Door Finish: Factory primed and field finished.
7. Sound Seals: Integral in door and/or frame, or as recommended by door and frame manufacturer to meet acoustic requirements indicated.
8. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds, maximum, in compliance with ADA Standards.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Sound-Rated Door Frames: Knock-down type.

C. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
1. UL listed products in compliance with requirements of authorities having jurisdiction.
2. Provide surface mounted acoustical astragal to cover space for full door height between pair of doors, with necessary cutouts for door hardware.

B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08 71 00.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

D. Coordinate installation of electrical connections to electrical hardware items.

E. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for hollow metal doors.

B. Thresholds.

C. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA (CPD) - Certified Products Directory; Current Edition.

C. BHMA A156.1 - Standard for Butts and Hinges; 2021.

D. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2022.

E. BHMA A156.4 - Door Closers and Pivots; 2024.

F. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

G. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

H. BHMA A156.7 - Template Hinge Dimensions; 2022.

I. BHMA A156.18 - Standard for Materials and Finishes; 2020.

J. BHMA A156.21 - Thresholds; 2019.

K. BHMA A156.22 - Standard for Gasketing; 2021.

L. BHMA A156.30 - High Security Cylinders; 2020.

M. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.

P. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 437 - Standard for Key Locks; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
   1. Architect/Engineer.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
   3. List groups and suffixes in proper sequence.
   4. Provide complete description for each door listed.
   5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Installer's qualification statement.

E. Supplier's qualification statement.

F. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Lock Cylinders: One for each master keyed group.
   3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Listed and certified compliant with specified standards by BHMA (CPD).

D. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Hinges: Comply with BHMA A156.1, Grade 1 for heavy weight hinges, Grade 2 for standard weight hinges.
   1. Provide hinges on every side-swinging door.

B. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   1. Manufacturers:
      a. BEST, dormakaba Group; CB Series or FBB Series: www.bestaccess.com.
      b. Hager Companies; BB Series: www.hagerco.com.
      c. Ives, an Allegion brand; 5BB1 Series: www.allegion.com/us.
      d. McKinney; an Assa Abloy Group company; TB Series or TCB Series: www.assaabloydss.com. (Note: TA Series and MacPro hinges are not acceptable.)
      e. Substitutions: Not permitted.
   2. Imported or so-called "economical" or "contractor grade" hinges are not acceptable.

3. Size: Sufficient to clear trim and allow doors, otherwise free of obstruction, to open 180 degrees.
    a. Door Leaves Up To 36 inches Wide and 1¾ inches Thick: 4½ x 4 ½ inch.
    b. Door Leaves over 36 inches Wide And/Or Over 1¾ inches Thick: 5 x 5 inches.
4. Material:
    a. Interior Door Leafs Up To 36 Inches Wide: Wrought or stainless steel, standard weight (0.134 inch).
    b. Vestibule Doors, Exterior Doors, and Door Leafs Over 36 Inches Wide: Solid bronze or stainless steel, heavy weight (0.180 or 0.190 inch).
5. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
6. Provide ball-bearing hinges at each door with closer.
7. Provide non-removable pins on exterior outswinging doors.
8. Provide following quantity of butt hinges for each door:
    a. Doors From 60 inches High up to 90 inches High: Three hinges.
    b. Doors 90 inches High up to 120 inches High: Four hinges.

2.03 LOCK CYLINDERS AND KEYING

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
    1. Provide standard conventional type mechanical cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 for interior doors.
    2. Provide high security conventional type mechanical cylinders, Grade 1, with seven-pin core in compliance with BHMA A156.30 or UL 437 for exterior doors.
    3. Provide cylinders from same manufacturer as locking device.
    4. Provide cams and/or tailpieces as required for locking devices.

2.04 CYLINDRICAL LOCKS

A. Manufacturers:
    1. Schlage, an Allegion brand; ND Series with RHO Lever: www.allegion.com/us.
    2. Substitutions: Not permitted.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
    1. Bored Hole: 2-1/8 inch diameter.
    2. Latchbolt Throw: 1/2 inch, minimum.
    3. Backset: 2-3/4 inch unless otherwise indicated.
    4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
        a. Finish: To match lock or latch.
    5. Provide locksets that require no more than one operation to simultaneously unlock and unlatch doors in the direction of egress.
    6. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.05 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
    1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
    2. Hager Companies: www.hagerco.com.

3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
4. Trimco: www.trimcohardware.com.
5. Substitutions: Not permitted.

B. Door Pulls and Push Plates: Comply with BHMA A156.6.
1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.
3. Material: Stainless steel, unless otherwise indicated.
4. Provide door pulls and push plates on doors without a lockset, latchset, exit device, or auxiliary lock unless otherwise indicated.
5. On solid doors, provide matching door pull and push plate on opposite faces.
6. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

2.06 CLOSERS

A. Manufacturers; Surface Mounted:
1. LCN, an Allegion brand; 4040XP Series: www.allegion.com/us.
2. Substitutions: Not permitted.

B. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: Surface mounted to door.
2. At corridor entry doors, mount closer on room side of door.

2.07 PROTECTION PLATES

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com.
3. Hiawatha, Inc, an Activar Construction Products Group company: www.activarcpg.com/hiawatha.
4. Ives, an Allegion brand: www.allegion.com/us.
5. Trimco: www.trimcohardware.com.
6. Substitutions: Not permitted.

B. Protection Plates: Comply with BHMA A156.6.

C. Metal Properties: Aluminum material.
1. Metal, Standard Duty: Thickness 0.050 inch, minimum.

D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

F. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.08 THRESHOLDS

A. Manufacturers:
   1. Pemko; an Assa Abloy Group company; 18/1 Series: www.assaabloydss.com.
   2. Hager Companies; 676S Series: www.hagerco.com.
   3. National Guard Products, Inc; 818: www.ngpinc.com.
   4. Reese Enterprises, Inc; BAP18: www.reeseusa.com.
   5. Substitutions: Not permitted.

B. Thresholds: Comply with BHMA A156.21.
   1. Type: Flat plate.
   2. Material: Stainless steel or aluminum.
   3. Width: 3 inches.
   4. Threshold Surface: Smooth and flat.
   5. Field cut threshold to profile of frame and width of door sill for tight fit.

2.09 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
   2. Hager Companies: www.hagerco.com.
   3. National Guard Products, Inc: www.ngpinc.com.
   4. Reese Enterprises, Inc: www.reeseusa.com.
   5. Substitutions: Not permitted.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Head and Jamb Type: Adjustable.
   2. Door Sweep Type: Encased in retainer.
   3. Material: Aluminum, with silicone, neoprene or santoprene insert.
   4. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

2.10 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
   2. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Door Closer Covers and Arms: Color as selected by Architect/Engineer from manufacturer's standard colors unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until application of finishes to substrate are fully completed.

D. Install hinges plumb and true regardless of frame conditions.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: See Section 08 11 13.
   2. Mounting heights in compliance with ADA Standards: Refer to schedule on the Drawings.

F. Set door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous sound seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

B. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

D. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

H. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

I. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

K. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

L. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

M. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

Q. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich Building Systems: www.clarkdietrich.com.
   2. Marino\WARE: www.marinoware.com.
   3. Steel Construction Systems: www.steelconsystems.com.
   4. The Steel Network, Inc: www.steelnetwork.com.

5. Super Stud Building Products, Inc: www.buysuperstud.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com/.
5. USG Corporation: www.usg.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
a. Mold resistant board is required at all locations.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:
a. Vertical Surfaces: 5/8 inch.
b. Ceilings: 5/8 inch.
5. Mold-Resistant, Paper-Faced Products:
a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com.
b. American Gypsum Company; M-Bloc Type C: www.americangypsum.com.
c. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com.
d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com.
e. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com.
f. USG Corporation; USG Sheetrock Brand EcoSmart Panels Mold Tough Firecode X: www.usg.com.
g. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3 inch unless indicated otherwise on the Drawings.

B. Acoustic Insulation: See Section 07 21 00.

C. Acoustical Shielding: Mineral-filled recycled polyvinyl chloride (PVC) or viscoelastic polymer sheet membrane; applied between studs and gypsum board.
   1. Surface Burning Characteristics: Provide assemblies with Class I rating, when tested in accordance with ASTM E84.
   2. Weight: 1 lb per square foot.
   3. Products:
      a. Acoustiblok; Blok16: www.acoustiblok.com.
      b. AcoustiGuard – WILREP LTD; Noise-Blok 1lb: www.acoustiguard.com.
      c. Axousatimac; Soundlock 1lb: www.acoustimac.com
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
   1. Products:
      a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com.
      b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com.
      c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Finishing Accessories: ASTM C1047, paper-faced galvanized steel, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Manufacturers: As for framing materials.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape or creased paper tape for joints and corners, except as otherwise indicated.
   2. Joint Compound: Drying type, vinyl-based, ready-mixed.
   3. Joint Compound: Setting type, field-mixed.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 16 inches on center.
   1. Orientation: Vertical.
   2. Spacing: As indicated on the Drawings.

F. Blocking: Install wood blocking for support of:
   1. Framed openings.
   2. Wall-mounted cabinets.
   3. Plumbing fixtures.
   4. Toilet accessories.
   5. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place continuous bead at perimeter of each layer of gypsum board.
   2. Seal around all penetrations by conduit, pipe, ducts, rough-in boxes, and structural and supporting elements, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at base layer of double-layer applications.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

B. Section 23 37 00-Air Outlets and Inlets: Air diffusion devices in ceiling.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. USG: www.usg.com.
   2. Substitutions: Not permitted.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Rockfon, LLC; Chicago Metallic: www.rockfon.com.
   4. USG: www.usg.com.
   5. Substitutions: Not permitted.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
      a. Form: 1 and 2.
      b. Pattern: "G" - smooth.
   2. Size: 24 by 24 inches.
   3. Thickness: 5/8 inch.
   4. Light Reflectance: 86 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.55, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Panel Edge: Tegular - SLT.
   8. Color: White.
   9. Suspension System: Exposed grid.
   10. Products:
      a. USG Corporation; Astro Acoustical Panels #8223: www.usg.com/ceilings.
      b. Substitutions: Not permitted.

2.03 SUSPENSION SYSTEM

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

1. Materials:
   a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dip galvanized steel grid with steel cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 15/16 inch face width.
   3. Finish: Baked enamel.
   4. Color: White.
   5. Products:
      a. Armstrong World Industries, Inc; Prelude XL: www.armstrongceilings.com.
      b. Certainteed Architectural; 15/16" EZ Stab Classic System: www.certainteed.com/ceilings-and-walls.
      c. USG Corporation; Donn Brand DX/DXL 15/16 inch Acoustical Suspension System: www.usg.com/ceilings.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and ASTM E580/E580M and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
1. Make field cut edges of same profile as factory edges.
2. Double cut and field paint exposed reveal edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION

SECTION 09 65 00
RESILIENT BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

B. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; 2002.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect/Engineer's initial selection.

E. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

1.05 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; style as scheduled.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company: www.johnsonite.com.
      b. Roppe Corporation: www.roppe.com.

c. Substitutions: See Section 01 60 00 - Product Requirements.
2. Height: 4 inches.
3. Thickness: 0.125 inch.
4. Finish: Satin.
5. Length: Roll.
6. Color: Match existing.

2.02 ACCESSORIES

A. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

B. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to base manufacturer, free of cracks that might telegraph through base, clean, dry, and free of chemicals that might interfere with bonding of base to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

A. Clean substrates.

B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set base in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Interior painting and coating systems.

C. Scope:
   1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
      a. Interior:
         1) Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
         2) Metal: Structural steel columns, joists, trusses, beams, miscellaneous and ornamental iron, structural iron, and ferrous metal.
         3) Drywall: Walls, ceilings, gypsum board, and similar items.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

C. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.

C. Samples: Submit two paper draw down samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

D. Maintenance Data: Submit coating maintenance manual including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care

and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to manufacturer's label.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

C. Paint Materials: Store at a minimum of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Handling: Maintain a clean, dry storage area to prevent contamination or damage to materials.

1.06 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; www.sherwin-williams.com.

B. Comparable Products: Products of approved manufacturers will be considered in accordance with 01 60 00 - Product Requirements, and the following:
   1. Products that meet or exceed performance and physical characteristics of basis of design products.

2.02 PAINTINGS AND COATINGS

A. General:
   1. Provide factory-mixed coatings unless otherwise indicated.
   2. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. SCAQMD 1113 Rule.
   c. CARB (SCM).
   d. Architectural coatings VOC limits of State in which the project is located.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site, or other method acceptable to authorities having jurisdiction.

C. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SYSTEMS - INTERIOR

A. Masonry CMU:
   1. Latex Systems:
      a. Semi-Gloss Finish High Performance (HP):
         1) 1st Coat: Sherwin-Williams PrepRite Block Filler, B25W25: www.sherwin-williams.com.
            a) 75 to 125 sq ft/gal.
         2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 HP Zero VOC Latex Semi-Gloss, B31-1950 Series: www.sherwin-williams.com.
            a) 4 mils wet, minimum; 1.6 mils dry, minimum; per coat.

B. Metal: Doors, frames, miscellaneous metal items.
   1. Alkyd Systems, Water Based:
      a. Semi-Gloss Finish:
         1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: www.sherwin-williams.com.
            a) 5 mils wet, minimum; 2 mils dry, minimum; per coat.
         2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series: www.sherwin-williams.com.
            a) 4 to 5 mils wet, 1.4 to 1.7 mils dry per coat.

C. Drywall: Walls, ceilings, gypsum board, and similar items.
   1. Latex Systems:
      a. Eg-Shel Finish High Performance (HP):
         1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com.
            a) 4 mils wet, minimum; 1.5 mils dry, minimum; per coat.
         2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 HP Zero VOC Eg-Shel, B20-1950 Series: www.sherwin-williams.com.
            a) 4 mils wet, minimum; 1.7 mils dry, minimum; per coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.

D. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk.
   2. Fill bug holes, air pockets, and other voids with cement patching compound.
   3. Prepare concrete in accordance with SSPC-SP 13/NACE No.6.

E. Masonry: Remove efflorescence and chalk.

F. Cementitious Siding: Remove dirt, dust and other foreign matter. Pressure clean, if needed, to remove grease, oil, and loose particles.

G. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.

H. Plaster: Fill hairline cracks, small holes, and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Treat textured, soft, porous, or powdery surfaces in accordance with manufacturer's instructions.

I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

K. Wood: Remove dust, grit, and foreign matter. Scrape, sand, and spot prime knots and pitch streaks. Fill nail holes and imperfections with wood filler and sand smooth.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.

D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

3.04 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.

B. Mechanical couplings.

C. Pipe hangers and supports.

D. Pipe sleeves.

1.02 RELATED REQUIREMENTS

A. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

F. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

G. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2013.

H. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

I. AWWA C606 - Grooved and Shouldered Joints; 2011.

J. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. Minimum three years experience.

C. Conform to UL and FM requirements.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

E. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Sprinkler-based System:
   1. Comply with NFPA 13.
   2. See Section 21 13 00.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: Schedule 40, black.
   1. Steel Fittings: ASME B16.9 wrought steel, buttwelded or ASME B16.25 buttweld ends.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.03 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Not required for wall hydrants for fire department connections or in drywall construction.

D. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 to prevent the spread of fire, smoke, and gases.

2.04 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Vertical Support: Steel riser clamp.

E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.05 MECHANICAL COUPLINGS

A. Manufacturers:
1. Anvil International.
2. Tyco Fire Protection Products.
3. Victaulic Company; FireLock Style 009H.

B. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating walls and partitions and seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   2. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 to prevent the spread of fire, smoke, and gases.
   3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 21 13 00
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

1.02 RELATED REQUIREMENTS

A. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. ITS (DIR) - Directory of Listed Products; Current Edition.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:
   1. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
   2. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect/Engineer.

D. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements for additional provisions.
   2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
   3. Sprinkler Wrenches: For each sprinkler type.

F. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

A. Conform to FM (AG) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located. Or a holder of a valid NICET level III or IV Sprinkler Technician.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

E. Equipment and Components: Provide products that bear ITS (DIR) label or marking.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Water Supply: Determine volume and pressure from water flow test data.

2.02 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Chrome plated.
   4. Escutcheon Plate Finish: Chrome plated.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Upright type with guard.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Guards: Finish to match sprinkler finish.

2.03 STAINLESS STEEL FLEXIBLE DROPS

A. Manufacturers:
   1. Flex Head Industries, Inc.
   2. Aqua Flex.
   3. Victaulic Company.

B. In lieu of rigid pipe offsets or return bends. Braided type 304 stainless steel flexible tube with male threaded pipe nipple for connection to branchline piping, and a zinc plated steel reducer with a 1/2"

or 3/4" NPT female thread for connection to a sprinkler head. The hoses shall be factory-pressure tested to 400 psi.

C. Flexible drop shall attach to the ceiling grid with open gate bracket and can be installed without the use of special tools.

D. The braided drop shall be FM approved for sprinkler services to 200 psi.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Place pipe runs to minimize obstruction to other work.

D. Place piping in concealed spaces above finished ceilings.

E. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

G. Flush entire piping system of foreign matter.

H. Install guards on sprinklers exposed sprinklers within 8' of finished floor.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

3.03 SCHEDULES

A. System Hazard Areas:
   1. Classrooms: Light Hazard.
   2. Equipment and Storage Rooms: Ordinary Hazard, Group 2.
   3. Other Areas: In accordance with NFPA 13.

END OF SECTION

SECTION 22 10 05
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.

1.02 REFERENCE STANDARDS

A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

B. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

C. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

D. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

E. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

F. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

G. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).

H. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

I. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

K. Safe Drinking Water Act, Section 1417 - Lead Free: Refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content <= 0.25%, Amended January 4, 2011.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Perform Work in accordance with City plumbing ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, ABOVE GRADE (ABOVE RETURN AIR PLENUM CEILINGS)

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.29, wrought copper, or ASME B16.32, sovent.
   2. Joints: ASTM B32, alloy Sn50 solder.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Remove scale and dirt, on inside and outside, before assembly.

B. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

G. Sleeve pipes passing through partitions, walls and floors.

H. Pipe Hangers and Supports:
   1. Support horizontal piping as indicated.
   2. Install hangers to provide 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 other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

3.05 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 1/2 inch.
      b. Pipe Size: 4 inches to 6 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 5/8 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.

B. Cleanouts.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company.
   2. Zurn Industries, Inc.
   3. MIFAB.

B. Floor Drain FD-1:
   1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and 8-1/2 inch round, medium duty ductile iron bar grate.
   2. J.R. Smith Model 2110-M.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company.
   2. Zurn Industries, Inc.
   3. MIFAB.

B. Cleanouts at Interior Finished Floor Areas FCO:
   1. Lacquered cast iron body with anchor flange, threaded scoriated secured stainless steel top, and ABS gasketed plug.
   2. J.R. Smith Model 4020-SS.

C. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round taper threaded bronze plug, and round stainless steel access cover secured with machine screw.
   2. J.R. Smith Model 4422.

D. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type.
   1. J.R. Smith Model 4510.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 05 19
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gages and pressure gage taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.01 PRESSURE GAGES

A. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAGE TAPPINGS

A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

2.03 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gages, one gage adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Coil and conceal excess capillary on remote element instruments.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

I. Locate test plugs adjacent thermometers and thermometer sockets.

3.02 SCHEDULE

A. Pressure Gauges, Location and Scale Range:
   1. Pumps, 0 to 60 psi.

B. Stem Type Thermometers, Location and Scale Range:
   1. Heating Coil banks - inlets and outlets, 0 to 240 degrees F.

2. Cooling Coil banks - inlets and outlets, 0 to 100 degrees F.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Nameplates.

C. Air Terminal Units: Ceiling tacts.

D. Automatic Controls: Tags. Key to control schematic.

E. Control Panels: Nameplates.

F. Instrumentation: Tags.

G. Major Control Components: Nameplates.

H. Piping: Pipe markers.

I. Pumps: Nameplates.

J. Relays: Tags.

K. Thermostats: Nameplates.

L. Valves: Tags.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc.
   2. Kolbi Pipe Marker Co.
   3. Seton Identification Products, a Tricor Direct Company.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Conform to ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Brady Corporation.
   2. Kolbi Pipe Marker Co.
   3. Seton Identification Products, a Tricor Company.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation.
   2. Kolbi Pipe Marker Co.
   3. Seton Identification Products, a Tricor Company.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.

F. Identify service, flow direction, and pressure.

G. Install in clear view and align with axis of piping.

H. 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.

I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   4. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
   5. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect/Engineer.
      g. Project Contractor.
      h. Report date.

C. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   4. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a 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. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

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.

3.04 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

I. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

J. For Variable air volume systems, measure the minimum outside airflow at the following fan speeds and record the outside air damper positions: Minimum fan speed, 50% fan speed, 75% fan speed, 100% fan speed.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure in areas as noted.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.07 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Air Handling Units.
   3. Fans.
   4. Air Terminal Units.
   5. Air Inlets and Outlets.

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

C. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation.:
   2. Johns Manville.:
   3. Owens Corning Corporation.:
   4. CertainTeed Corporation.:

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Minimum installed R-Value: 6.0.
   3. Maximum Service Temperature: 450 degrees F.
   4. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 DUCT LINER

A. Manufacturers:
   1. Knauf Insulation.:
   2. Johns Manville.:
   3. CertainTeed Corporation.:

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.

2. Apparent Thermal Conductivity: Maximum of 0.25 at 75 degrees F.
3. Service Temperature: Up to 250 degrees F.
4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
5. Minimum Noise Reduction Coefficients:
   a. 1 inch Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier 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.

D. Insulated ducts conveying air above ambient temperature:
1. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. Duct Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts withing 10ft of the exterior:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

B. Outside Air Intake Ducts:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

C. Supply Ducts:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

D. Supply Ducts/Terminal Units Reheat Coils:
   1. Flexible Glass Fiber Duct Insulation: 2 inches thick.

E. Return Ducts:
   1. Duct Liner: 1 inches thick.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation.:
   2. Johns Manville Corporation.:
   3. Knauf Insulation.:
   4. Owens Corning Corporation.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc.
   2. Armacell LLC.
   3. K-Flex USA LLC.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature.
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   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.

I. 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: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:

a. Glass Fiber Insulation:
    1) Pipe Size Range: Up to and including 1-1/4 inch.
        a) Thickness: 1-1/2 inch
    2) Pipe Size Range: 1-1/2 inch and above.
        a) Thickness: 2 inch.

B. Cooling Systems:
1. Chilled Water:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: All sizes.
            a) Thickness: 2 inch
2. Condensate Drains from Cooling Coils:
    a. Flexible Elastomeric Cellular Insulation:
        1) Pipe Size Range: All sizes.
            a) Thickness: 1/2 inch

C. Dual Temperature Water:
1. Glass Fiber Insulation:
    a. Pipe Size Range: Up to and including 1-1/4 inch.
        1) Thickness: 1-1/2 inch
    b. Pipe Size Range: 1-1/2 inch and above.
        1) Thickness: 2 inch.

END OF SECTION

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:
   1. Ball valves and actuators.
   2. Globe pattern.
   3. Electronic operators.

C. Pressure independent control valves and actuators.

D. Damper Operators:
   1. Electric operators.

E. Input/Output Sensors:
   1. Temperature sensors.
   2. Humidity sensors.
   3. Static pressure (air pressure) sensors.
   4. Equipment operation (current) sensors.
   5. Damper position indicators.
   6. Carbon dioxide sensors.

F. Thermostats:
   1. Electric room thermostats.
   2. Room thermostat accessories.
   3. Outdoor reset thermostats.
   4. Immersion thermostats.
   5. Airstream thermostats.
   6. Electric low limit duct thermostats.

G. Transmitters:
   1. Building static pressure transmitters.
   2. Pressure transmitters.
   3. Air pressure transmitters.
   4. Temperature transmitters.
   5. Humidity transmitters.

H. Low Coil Input Relays.

I. Air Flow Measuring Stations.

1.02 RELATED REQUIREMENTS

A. Section 23 05 19 - Meters and Gauges for HVAC Piping: Thermometer sockets, gage taps.

B. Section 23 09 23 - Direct-Digital Control System for HVAC.

C. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gage taps.

D. Section 23 21 14 - Hydronic Specialties.

E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.

B. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2013.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; 2013.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.04 SUBMITTALS

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

C. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

D. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience approved by manufacturer.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Pressure Independent Control Valve.
   1. Manufacturers.
      a. Danfoss; Model AB-QM.
      b. Flow Control Industries; Model DeltaPValve.
      c. Johnson Controls.
   2. ASME B16.34 or ASME B16.15, valve bodies shall be two-way normally open or closed. Valve bodies 2 inches and smaller shall be bronze or brass. Valve bodies 2-1/2 inches and larger shall be brass, bronze or iron.
   3. Valve shall be two way globe style, pressure independent, with integrated differential pressure control regulator. Regulation control of pressure shall be by an integrated EPDM diaphragm design, stainless spring, pressure control disc and require no internal maintenance or replaceable cartridges. Pressure control seat shall be brass construction with vulcanized EPDM.
   4. Provide user adjustable maximum flow within valve control range; adjustment method shall indicate percentage of valve flow range and utilize spring locked method of adjustment.
   5. Regulation of internal control valve differential pressure shall provide 100% control valve authority and maintain a linear flow characteristic.
   6. Flow shall be accurately controlled from 0-100% full rated flow with an operating pressure differential range of 4 to 60 psig.
   7. Valve shall provide back seated globe design to allow service of packing under pressure without leakage for valves up to 1-1/4 inches.
   8. Valve shall include PT test ports.
   9. Actuator shall operate the valve through its' full range and have a minimum close off pressure of 90 psig; have the ability to supply on/off, floating, proportional, safety spring and or feedback options; visible position indication; thermostatic, thermal or electronic version as indicated. Actuator shall be from the same manufacturer as the valve manufacturer.

B. Ball Valves and Actuators:
   1. Manufacturers:
      a. Belimo .
      b. Johnson Controls.
      c. Griswold Controls.
   2. Service: Use for brine (30 percent glycol), chilled water, or hot water.
   3. Flow Characteristic: Include 3-way mixing operation configured to fail normally open (NO).
   4. Rangeability: 500 to 1.
   5. ANSI Rating: Class 150.

6. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.
7. Body Size:
   a. Under 2-1/2 inches:
      1) Connection: NPT.
      2) Materials:
         a) Body: Brass.
         b) Flanges: Ductile iron.
         c) Ball: Chrome-plated brass.
         d) Stem: Nickel-plated brass.
         e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
         f) Stem Seal: EPDM O-Rings.
         g) Flow Control Disk: Thermoplastic synthetic-resin.
   b. Service Temperature:
      1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.
      2) Ambient Side: From minus 4 to 122 degrees F.
8. Actuator Requirements:
   a. Assembly: Factory-mounted.
   b. Input: 0 to 10 VDC configured for proportional control.
   c. Accessories: Provide with valve position indicator and manual override.

C. Globe Pattern:
   1. Manufacturers:
   2. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
   3. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
   4. Hydronic Systems:
      a. Rate for service pressure of 125 psig at 250 degrees F.
      b. Replaceable plugs and seats of stainless steel.
      c. Size for 3 psig maximum pressure drop at design flow rate.

2.04 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
   1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
   2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:
   1. Manufacturers:
      a. Belimo.
      b. Johnson Controls.
      c. Siemens.
   2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.05 INPUT/OUTPUT SENSORS

A. Temperature Sensors:
   1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
   2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
   3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
   4. Temperature Sensing Device: Compatible with project DDC controllers.
   5. Performance Characteristics:
      a. RTD:
         1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
         2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
         3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
         4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
         5) Range: Minus 40 degrees F through 220 degrees F minimum.
      b. Thermistor:
         1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
         2) Range: Minus 25 degrees F through 122 degrees F minimum.
         3) Heat Dissipation Constant: 2.7 mW per degree C.
      c. Temperature Transmitter:
         1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
         2) Output: 4 to 20 mA.
      d. Sensing Range:
         1) Provide limited range sensors if required to sense the range expected for a respective point.
         2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
         3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
      e. Wire Resistance:
         1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
         2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
      f. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
      g. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
      h. Temperature Averaging Elements:
         1) Use on duct sensors for ductwork 10 sq ft or larger.
         2) Use averaging elements where prone to stratification with sensor length 8 ft or 16 ft.
         3) Provide for all mixed air and heating coil discharge sensors regardless of duct size.
      i. Insertion Elements:
         1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
         2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.

B. Humidity Sensors:
   1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.
      a. Input Power, Voltage Type: Class 2; 12-30 VDC/24 VAC, 15mA max.
      b. Input Power, mA Type: Class 2; Loop powered 12-30 VDC only, 30 mA max.
      c. Output Voltage Type: 3-wire observed polarity.
      d. Output mA Type: 2-wire, not polarity sensitive (clipped and capped).
      e. Humidity:
         1) HS Element: Digitally profiled thin-film capacitive.
         2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.
            a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).
         3) Scaling: 0 to 100 percent RH.
      f. Temperature Effect:
         1) Duct Mounted: Plus/minus 0.18 percent per degree F.
         2) Outdoor Mounted: 4 to 20mA version: (0.0013x%RHx(TdegreeC-25)).
      g. Hysteresis: 1.5 percent typical.
      h. Linearity: Included in accuracy specification.
      i. Reset Rate: 24 hours.
      j. Stability: Plus/minus 1 percent at 68 degrees F (20 degrees C) annually, for two years.
      k. Operating Environment:
         1) Operating Humidity Range: 0 to 100 percent RH noncondensing.
         2) Operating Temperature Range: Minus 40 degrees F to 122 degrees F.

C. Static Pressure (Air Pressure) Sensors:
   1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
   2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
   3. Accuracy: One percent of full scale with repeatability 0.3 percent.
   4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation (Current) Sensors:
   1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
   2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
   3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.

F. Carbon Dioxide Sensors, Duct and Wall:
   1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
   2. Air Temperature: Range of 32 to 122 degrees F.
   3. Relative Humidity: Range of 0 to 95 percent (non-condensing).
   4. Power Input: Class 2; 12 to 30VDC or 24VAC 50/60 Hz; 100mA max.
   5. Calibration Characteristics:

a. Automatically compensating algorithm for sensor drift due to sensor degradation.
b. Maximum Drift: 2 percent.
c. User calibratable with a minimum calibration interval of 5 years.

6. Construction:
a. Sensor Chamber: Non-corrosive material for neutral effect on carbon dioxide sample.
b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
c. Housing: High impact plastic.

2.06 THERMOSTATS

A. Electric Room Thermostats: Matching Campus standard
1. Provide sensor type matching existing campus standard.
a. Provide metal wall plate for common corridors, provide with LCD display in all other areas.
2. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
3. Service: Cooling and heating.
4. Room thermostats shall be equipped with setpoint adjustment.
5. Thermostats shall match owner standard.

B. Outdoor Reset Thermostats:
1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.

C. Immersion Thermostats:
1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

D. Airstream Thermostats:
1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.

E. Electric Low Limit Duct Thermostats:
1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

2.07 TRANSMITTERS

A. Building Static Pressure Transmitters:
1. One pipe, direct acting, double bell, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

B. Pressure Transmitters:
1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

C. Air Pressure Transmitters:
1. General: Provide dry media differential pressure transducers to monitor duct and room pressure.
a. Media Compatibility: Dry air.

b. Input Power: Class 2; 12 to 30 VDC; 2-wire: 20 mA max.
c. Output: Field selectable, 2-wire, loop-powered 4 to 20 mA (DC only, clipped and capped).
d. Pressure Ranges: 4 and 7, field selectable.
e. Response Time:
1) Standard: T95 in 20 seconds.
2) Fast: T95 in 2 seconds.
3) Switch selectable.
f. Mode: Switch selectable, unidirectional.

D. Temperature Transmitters:
1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 50 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

E. Humidity Transmitters:
1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.08 LOW COIL INPUT RELAYS

A. Manufacturers
1. Functional Devices, Inc.; RIB
a. Encoded relay Hi/Low separation 20 amp DPDT +Override.
b. UL Listed, UL916, UL864, C-UL and UL Accepted for use in Plenum, NEMA 1.
c. Power input: 120 Vac, 50-60 Hz or 208-277 Vac, 50-60 Hz as applicable.
d. Control Input: 5-25 Vac/dc. 50-60 Hz.
e. Relay status: LED on = activated.

2.09 AIR FLOW MEASURING STATION

A. Manufacturers:
1. Ebtron, Inc.; Model Advantage II Gold Series.
2. Air Monitor Corp.
3. Johnson Controls.

B. Thermal dispersion airflow measurement device. Measuring device shall consist of one or more multi-point measuring probes and a single microprocessor-based transmitter. Transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or volumetric rate.

C. Transmitter shall operate on 24 VAC.

D. Transmitter shall be capable of communicating with building automation system using one of the following interface options:
1. Linear analog output signal: Field selectable, fuse protected and isolated, 0-10 VDC and 4-20 mA (4-wire).
2. RS-485: Field selectable ModBus.
3. 10 Base-T Ethernet: Field selectable ModBus TCP and TCP/IP.
4. LonWorks Free Topology.

E. Sensors shall be fabricated of anodized aluminum alloy tube with 303/304 stainless steel mounting brackets.

F. Airflow/temperature measuring devices shall be UL listed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches.

C. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

D. Provide separable sockets for liquids and flanges for air bulb elements.

E. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

F. Provide mixing dampers of parallel blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.

G. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

H. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

I. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

J. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

G. HVAC control programs.

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

1.03 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Expand building Johnson Controls, Inc. building control system to interface with new equipment and perform the sequence of operation specified. Modify automation system graphics to delete removed equipment and add new equipment.

B. Provide a color graphical representation of all systems. The graphical display shall include all points indicated in the pints list and any others required to achieve the sequences of operation. The graphical user interface shall consist of the following as a minimum;
   1. Menu bar navigation via windows-like bars.
   2. Navigation will also be available via an image of the building profile from which the user clicks on floors to bring up individual floor plans.
   3. The individual floor plan zones shall change color based upon the difference between the actual zone temperature and zone set point so that the operator can tell at a glance if zones are in, above or below acceptable ranges. A minimum of five (5) colors are required: Color 1 = within acceptable range of set point, Color 2 = warning - zone is above acceptable range of set point and approaching high temperature alarm; Color 3 = zone is in high temperature alarm; Color 4 = warning - zone is below acceptable range of set point and approaching low temperature alarm; Color 5 = zone is in low temperature alarm.
   4. Clicking on a floor plan zone shall bring up a dynamic color graphic of the mechanical equipment that serves that zone.

5. Each major piece of mechanical equipment (terminal unit, AHU, boiler, chillers, cooling towers, etc.) shall have a pictorial dynamic color graphic. The central plant equipment may be combined as appropriate on one or more graphic page.
6. Text-based (non-pictorial) summary screens will also be provided so that the operator may view critical information on multiple units at once. Summary screens will be provided for terminal units and air handling units. Summary screens for VAV/FPVAV boxes will contain as a minimum room temperature, room temperature set point, occ/unocc status and CFM for each box. Summary screens for AHUs will contain as a minimum space temperature (CV units) or discharge temperature (VAV units) and the corresponding set point, static pressure (VAV units), OA damper position, mixed air temperature, fan status and occ/unocc status.
7. Clicking on a unit on any summary screen shall bring up the complete graphic for that unit.
8. Outside air temperature shall be displayed on each graphic screen.

1.05 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet and LonWorks technology communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI/ASHRAE Standard 135-1995, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide a XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device = s-compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet.

C. All components and controllers supplied under this contract shall be true peer-to-peer communicating devices. Components or controllers requiring polling by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. The installed system shall provide secure password access to all features, functions and data contained in the overall Building Management Control System (BMCS). Secure Socket Layer (SSL) encryption shall be an available option for remote access.

F. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.

G. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus

only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.

H. The BMCS shall provide support for ODBC or SQL. An embedded database must be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write dated stored within it. A minimum offering would be the documentation of database schemes to allow users to read/write data into other applications using appropriate ODBS syntax.

I. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data.
   1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
   2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

1.06 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMCS shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface (GUI). Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions;
   1. User log-in identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
   2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
   3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
   4. Storage of the graphical screens shall be in the Network Area Controller (NAC) without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

1.07 SUBMITTALS

A. Product Data: Provide data for each system component and software module.

B. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.
   3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
   4. Indicate description and sequence of operation of operating, user, and application software.

C. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

D. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls, Inc; Metasys. Jim Pierson - 708-418-2268.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. Interface new controller into existing Campus building automation system.

B. Local Controller Display: JCI Model DIS1710.
   1. Field equipment controller that is stand-alone display that provides a local user interface into applications running in the field controller. Display shall allow setpoints monitoring, setpoints adjustment, issue commands, change occupancy and other miscellaneous tasks.

2.04 CONTROLLERS

A. BUILDING CONTROLLERS
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
      b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      c. Share data between networked controllers.
      d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      e. Utilize real-time clock for scheduling.
      f. Continuously check processor status and memory circuits for abnormal operation.
      g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      h. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet IP network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
      b. Perform routing when connected to a network of custom application and application specific controllers.
      c. Provide service communication port for connection to a portable operator's terminal or handheld device with compatible protocol.
   3. Anticipated Environmental Ambient Conditions:
      a. Conditioned Space:
         1) Mount within dustproof enclosures.
         2) Rated for operation at 32 to 120 degrees F.
   4. Provisions for Serviceability:
      a. Diagnostic LEDs for power, communication, and processor.
      b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
   5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
   6. Power and Noise Immunity:
      a. Maintain operation at 90 to 110 percent of nominal voltage rating.
      b. Perform orderly shutdown below 80 percent of nominal voltage.
      c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. CUSTOM APPLICATION CONTROLLERS
   1. General:

a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
b. Share data between networked, microprocessor based controllers.
c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
d. Utilize real-time clock for scheduling.
e. Continuously check processor status and memory circuits for abnormal operation.
f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
g. Communication with other network devices to be based on assigned protocol.

2. Communication:
   a. Controller to reside on a BACnet network using IP (ethernet) protocol.
   b. Provide service communication port for connection to a portable operator's terminal or handheld device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LED's for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. INPUT/OUTPUT INTERFACE
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
   1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
   2. Limit connected loads to 80 percent of rated capacity.
   3. Match DC power supply to current output and voltage requirements.
   4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
   5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
   6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
   7. Operational Ambient Conditions: 32 to 120 degrees F.
   8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
   9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.06 FIELD DEVICES

A. Networked Thermostat (NT)
   1. The NT shall communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
      a. The NT shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
      b. The NT shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
      c. A BACnet Protocol Implementation Conformance Statement shall be provided for the NT.
      d. The Conformance Statement shall be submitted 10 days prior to bidding.
   2. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interface through a Network Automation Engine.
   3. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
      a. Two line, 8 character backlit display
      b. LED indicators for Fan, Heat, and Cool status
      c. Five (5) User Interface Keys
         1) Mode
         2) Fan
         3) Override
         4) Degrees C/F
         5) Up/Down
      d. The display shall continuously scroll through the following parameters:
         1) Room Temperature
         2) System Mode
         3) Schedule Status - Occupied/Unoccupied/Override
         4) Applicable Alarms
   4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
      a. Integral Indoor Air Temperature Sensor
      b. Duct Mount Air Temperature Sensor
      c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
      d. Two configurable binary inputs
   5. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
      a. Three Speed Fan Control
      b. Two On/Off
      c. Two Floating
      d. Two Proportional (0 to 10V)
   6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.

7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling deadband from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. Where required by application and indicated on plans or room schedules provide the Networked Thermostat with an integral Passive Infra-Red (PIR) occupancy sensor.
9. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

2.07 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

C. LAN Data Speed: Minimum 19.2 Kb.

D. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

E. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.

F. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.08 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and usernames.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.

b. Alarms to be routed to appropriate workstation.
c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation shown on the Drawings.

H. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

K. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.09 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Fault Detection & Diagnostics:
1. Fault detection and diagnostics (FDD) shall monitor the HVAC system's performance and automatically identify faults.
2. Comply with International Energy Conservation Code (current edition).
3. The FDD shall:
a. Include permanently installed sensors and devices to monitor the HVAC system's performance.
b. Sample the HVAC system's performance at least once every 15 minutes.
c. Automatically identify and report HVAC system faults.
d. Automatically provide prioritized recommendations for repair of identified faults bases on analysis data collected from the sampling of HVAC system performance.
e. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

C. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Based on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.

3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.

D. Supply Air Reset:
1. Monitor heating and cooling loads in building spaces, terminal reheat systems, and single zone unit discharge temperatures.

E. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator workstation. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator workstation. Implement all features of programs to specified requirements and appropriate to sequence of operation.

C. Provide conduit and electrical wiring in accordance with Section 26 05 00. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
1. Provide conduit for all control wiring exposed to view. This includes but is not limited to all storage rooms, mechanical rooms, and similar spaces.
2. Provide conduit for all control wiring concealed in inaccessible spaces. This includes but is not limited to wiring above/behind drywall and plaster ("hard") ceilings or soffits, and wiring within vertical chase spaces, regardless of whether access doors are provided or not.
3. Control wiring that is concealed above readily accessible ceilings such as acoustical lay-in ceilings, need not be run in conduit.

D. All exposed conduit wiring that is not located above an accessible ceiling shall be installed in conduit. This includes all storage room, mechanical rooms, etc.

3.03 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Chilled water piping, above grade.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 23 07 19 - HVAC Piping Insulation.

B. Section 23 21 14 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

D. ASME B31.9 - Building Services Piping; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

H. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

I. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992, with Editorial Revision (2018).

K. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2013).

L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

N. AWWA C606 - Grooved and Shouldered Joints; 2011.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SUBMITTALS

A. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 WARRANTY

A. Provide 50 year limited warranty on press fittings from date of installation.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
   1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.

2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
3. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
4. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.
5. In heating water or chilled water systems, butterfly valves may be used interchangeably with gate and globe valves.
6. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
1. Fittings: ASME B16.18, cast brass/bronze or ASME B16.22, wrought copper and bronze.
2. Solder Joints:
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), hard drawn; using one of the following joint types:
1. Fittings: ASME B16.18, cast brass/bronze or ASME B16.22, wrought copper and bronze.
2. Solder Joints:
a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.

D. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

J. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

K. 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.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:
   1. Ferrous Piping: 150 psig malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
   4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. Dielectric Connections:
   1. Waterways:

a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
b. Dry insulation barrier able to withstand 600 volt breakdown test.
c. Construct of galvanized steel with threaded end connections to match connecting piping.
d. Suitable for the required operating pressures and temperatures.

2. Flanges:
a. Dielectric flanges with same pressure ratings as standard flanges.
b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
c. Dry insulation barrier able to withstand 600 volt breakdown test.
d. Construct of galvanized steel with threaded end connections to match connecting piping.
e. Suitable for the required operating pressures and temperatures.

2.07 BALL VALVES

A. Manufacturers:
1. Nibco, Inc; Model S-585-70-66.
2. Watts.
3. Apollo.

B. Up To and Including 2 Inches:
1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches:
1. Ductile iron body, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle, flanged ends, rated to 800 psi.

2.08 BUTTERFLY VALVES

A. Manufacturers:
1. Nibco; Model LD 2000.
2. Crane Valve.
3. Milwaukee Valve Company.

B. Body: Ductile iron with resilient molded-in EPDM seat, lug ends, extended neck.

C. Disc: Construct of aluminum bronze, geometric drive (one piece stem, no pin through disc).

D. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

E. Operator: 10 position lever handle.

2.09 SWING CHECK VALVES

A. Manufacturers:
1. Nibco, Inc.
2. Stockham.
3. Grinnell.
4. Jomar.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
2. Nibco Model S-433-Y.

C. Over 2 Inches:
1. Iron body, bronze trim, bronze faced rotating swing disc, renewable disc and seat, flanged ends.
2. Nibco Model F-918-B.

2.10 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Nibco, Inc.
2. Hammond Valve.
3. Milwaukee Valve Company.

B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Provide sleeve and watertight mechanical seal on all underground floor and wall penetrations.

G. Slope piping and arrange to drain at low points.

H. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.

I. Use eccentric reducers to maintain top of pipe level.

J. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.

B. Hanger Spacing for Steel Piping.
1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Automatic flow control valves.

D. Combination pump discharge valves.

E. Pressure-temperature test plugs.

1.02 RELATED REQUIREMENTS

A. Section 23 21 13 - Hydronic Piping.

1.03 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Project Record Documents: Record actual locations of flow controls.

C. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

A. Manufacturers:
   1. ITT Bell & Gossett.
   2. Taco, Inc.
   3. Armstrong Fluid Technology.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.02 STRAINERS

A. Manufacturers:
   1. The Metraflex Company.
   2. Wilkins.
   3. Watts Regulator.

B. Size 2 inch and Under:
   1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
   1. Provide flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.03 PUMP CONNECTORS

A. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Operating Service: 150 psi at 240 degrees F.
   2. End Connections: Same as specified for pipe jointing.
   3. Provide necessary accessories including, but not limited to, swivel joints.

2.04 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. ITT Bell & Gossett.
   2. Armstrong Fluid Technology.
   3. Taco, Inc.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.05 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. Ferguson Enterprises Inc.
   2. Peterson Equipment Company Inc.
   3. Sisco Manufacturing Company Inc.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.06 COMBINATION FLOW CONTROLS

A. Manufacturers:
   1. ITT Bell & Gossett.
   2. Armstrong Fluid Technology.
   3. Taco, Inc.

B. Construction:
   1. Up to 2 inches; Bronze body, bronze trim.

C. Control Mechanism: Y-pattern globe valve and digital handwheel with memory stop, inside screw, rubber O-ring disc, solder or screwed ends. Valve shall provide precise flow measurement, precision flow balancing, positive shut-off with no drip seat and drain port for hose bib fitting.
   1. Accessories: Provide pressure test plugs on inlet and outlet of balancing valve.

2.07 AUTOMATIC FLOW CONTROL VALVES

A. Manufacturers:
   1. Nexus.
   2. Flow Design.
   3. Griswold controls.
   4. Hays Fluid Controls.

B. Construction: Brass or bronze body with union on inlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

D. Control Mechanism:
   1. Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring. Internal flow cartridge shall be permanently marked with GPM and spring range. Cartridge shall be removable for changeout.
   2. Precision sculptured brass or polyphenylsulfone orifice with high temperature elastomeric diaphragm. Internal flow parts shall be permanently marked with flow performance. Components shall be removable for changeout.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. In-line circulators.

1.02 RELATED REQUIREMENTS

A. Section 23 07 19 - HVAC Piping Insulation.

B. Section 23 21 13 - Hydronic Piping.

C. Section 23 21 14 - Hydronic Specialties.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Fluid Technology.

B. ITT Bell & Gossett.

C. Taco, Inc.

2.02 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.03 IN-LINE CIRCULATORS

A. Type: Three-piece booster pump, horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi maximum working pressure.

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Oil-lubricated bronze sleeve.

E. Shaft: Heat treated carbon steel with bronze sleeve, integral thrust collar.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized combination pump discharge valve on pump discharge.

D. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

B. Section 23 33 00 - Air Duct Accessories.

C. Section 23 36 00 - Air Terminal Units.

D. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for flexible ducts.

C. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.07 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc of galvanized steel.
   2. Rectangular: Plus or minus 2 in-wc of galvanized steel.

C. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
      a. Supply Air: 2 in-wc pressure class, galvanized steel.
      b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.
      c. Return and Relief Air: 2 in-wc pressure class, galvanized steel.
      d. General Exhaust Air: 1 in-wc pressure class, galvanized steel.
   2. Low Pressure Service: Up to 2 in-wc:
      a. Seal: Class C, apply to seal off transverse joints.
      b. Leakage:
         1) Rectangular: Class 24 or 24 cfm/100 sq ft.
         2) Round: Class 12 or 12 cfm/100 sq ft.
   3. Low Pressure Service: From 2 in-wc to 3 in-wc:
      a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
      b. Leakage:
         1) Rectangular: Class 12 or 12 cfm/100 sq ft.
         2) Round: Class 6 or 6 cfm/100 sq ft.

D. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
   3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.

4. Construct tees, 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 must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Round Metal Ducts:
   1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
   2. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

C. Round Spiral Duct:
   1. Round spiral lock seam duct with galvanized steel outer wall.

D. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      b. VOC Content: Not more than 250 g/L, excluding water.
      c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
      d. For Use with Flexible Ducts: UL labeled.
   4. Gasket Tape:
      a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   5. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
   6. Hanger Cable & Fastener:
      a. Cable: Galvanized high tensile steel cable to EN12385. Standard lengths from 5 ft - 30 ft.

	No. 1	**No. 2**	**No. 3** (Standard)	**No. 3** (Trapeze)	**No. 4**	**No. 5**
Cable Dia. (in.)	1/16	5/64	1/8	1/8	3/16	1/4
Strand Configuration	7x7	7x7	7x7	1x19	7x19	7x19

Min. Breaking Load (lbs)	125	500	1,000	600	2,475	3,575
Max. Safe Working Load (lbs)	25	100	200	200	495	715
Tensile Strength (lbs/sq. in.)	256,700	256,700	256,700	256,700	256,700	256,700

b. Fastener:
   1) Housing: Type ZA2 Zinc.
   2) Wedge: Sintered steel hardened to minimum 56 Rockwell C.
   3) Spring: Stainless steel, Type 302.
   4) End Cap: No. 1-4 = UV stabilized homopolymer polypropylene; No. 5 = Type ZA2 zinc.
   5) Screws: No. 5 only = Stainless steel, Type 304.

c. Load Rating: All products 5:1 safety factor.

Size	**Maximum Safe Working Load**
No. 1	25 lbs
No. 2	100 lbs
No. 3	200 lbs
No. 4	495 lbs
No. 5	715 lbs

d. Manufacturers:
   1) Gripple Inc.: Air Flow Company, Inc..
   2) Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form a spiral helix.
   1. Insulation: R6 insulation with aluminized vapor barrier film.
   2. Pressure Rating: 10 in-wc positive and 5 in-wc negative.
   3. Maximum Velocity: 5500 fpm.
   4. Temperature Range: Minus 20 degrees F to 250 degrees F.
   5. Manufacturers:
      a. Flexmaster USA, a brand of Masterduct, Inc; Type 1.

B. Acoustic Flexible Ducts: UL 181, Class 1, spun-bond nylon, mechanically fastened and rolled using galvanized steel to form a spiral helix.
   1. Insulation: R6 insulation with aluminized vapor barrier film.
   2. Pressure Rating: 6 in-wc positive and 5 in-wc negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 20 degrees F to 250 degrees F.
   5. Accessories;
      a. Flex Duct kit. Maximum length 5 feet.
   6. Manufacturers:
      a. Flexmaster USA, a brand of Masterduct, Inc; Type 6.
      b. Substitutions: Not permitted.

C. Medium Pressure Flexible Ducts: UL 181, Class 1, aluminized laminate, mechanically fastened and rolled using galvanized steel to form a spiral helix.

1. Insulation: R6 insulation with aluminized vapor barrier film.
2. Inner Core: Tri-laminate of polyester, fiberglass, and aluminum foil.
3. Pressure Rating: 15 in-wc positive and 5 in-wc negative.
4. Maximum Velocity: 5500 fpm.
5. Temperature Range: Minus 20 degrees F to 250 degrees F.
6. Manufacturers:
   a. Flexmaster USA, a brand of Masterduct, Inc; Type 5.
   b. Thermaflex; Model MKC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Flexible Ducts: Connect to metal ducts with mechanical fastener.

F. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

G. Duct sizes indicated shall be of sizes indicated. However, necessary changes in shape offsets or crossovers to clear piping, lighting, building construction obstructions, etc. shall be made without additional cost.

H. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

K. Use double nuts and lock washers on threaded rod supports.

L. Connect terminal units to supply ducts directly or with 1 feet maximum length of flexible duct. Do not use flexible duct to change direction.

M. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

N. Duct Insulation: Provide duct insulation. See Section 23 07 13.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connections and forming brace.

E. Volume control dampers.

F. Miscellaneous products:
   1. Internal strut end plugs.
   2. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.

B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

B. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

C. Project Record Drawings: Record actual locations of access doors and test holes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc.

2. Ruskin Company.
3. Vent Products.
4. Pottorff

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
   1. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.03 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, airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.04 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: 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.
      a. Net Fabric Width: Approximately 2 inches wide.

2.05 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin Company.
   2. Pottorff.
   3. Greenheck.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. 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.

2.06 RETURN AIR CANOPY

A. Manufacturer's:
   1. Titus; Model RCP.
   2. Price; Model RAC.

B. Performance:
   1. Return air canopy performance characteristics, including noise reduction and pressure drop, shall be attained through testing using modified ASTM Standard E477.
   2. Laboratory performance verification in the manufacturer's test facility may be requested, in which case a comparative test report shall be made available to the engineer.

C. Construction:
   1. Return air canopies shall be constructed in accordance with ASHRAE and SMACNA Standards for the pressure and velocity classification specified for the air distribution system in which it is installed.
   2. Return air canopies shall be constructed of:
   3. 20-gauge solid steel casing
   4. Acoustic media:
      a. Absorptive acoustic fiberglass media.
   5. Acoustic media:
      a. Fiberglass media:
         1) Acoustic media shall be shot-free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin.
         2) Glass fiber shall be in accordance with erosion requirements of UL 181 and shall conform to the physical properties and requirements of ASTM C1071.

D. Fire-Performance Characteristics:
   1. Air transfer silencer assemblies, including acoustic media fill, sealants, and acoustical spacers shall have combustion rating equal to or less than shown below when tested according to ASTM E84, NFPA 255 or UL 723:
   2. Flame-spread index not exceeding 25
   3. Smoke-developed index not exceeding 50

2.07 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, 20 by 20 inch size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

F. 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.

G. Use splitter dampers only where indicated.

H. 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

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Square inline centrifugal fans and blowers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA 99 - Standards Handbook; 2010.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck.

B. Loren Cook Company; Model SQN-D VF.

C. Twin City Fan & Blower.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 SQUARE INLINE CENTRIFUGAL FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor.

B. The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.

C. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-05, balance quality and vibration levels for fans.

D. Motor shall be an electronically commutated motor rated for continuous duty and furnished either with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.

E. Accessories:
   1. External Signal Speed Control.
   2. VFABK Air Balance Kit.
   3. Motorized backdraft damper.
   4. Prewired disconnect switch, NEMA 1.
   5. Insulated Housing.
   6. Spring Isolators.
   7. Side discharge package.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads.
   2. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, variable-volume units.

1.02 RELATED REQUIREMENTS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 21 13 - Hydronic Piping: Connections to heating coils.

C. Section 23 31 00 - HVAC Ducts and Casings.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.

C. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2008 (R2014).

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

C. Project Record Documents: Record actual locations of units and controls components and locations of access doors required for access of valving.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:
   1. Price Industries, Inc.
   2. Titus.
   3. Nailor.

B. General:
   1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
   2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:
   1. Minimum 22 gage, 0.0299 inch galvanized steel.
      a. Assembled with longitudinal lock seam construction.
      b. Casing leakage to meet ASHRAE Std 130.
   2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
   3. Unit Discharge: Rectangular, with slip-and-drive connections.
   4. Acceptable Liners:
      a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
         1) Secure with adhesive.
         2) Coat edges exposed to airstream with NFPA 90A approved sealant.
         3) Cover liner with non-porous foil.
      b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

D. Damper Assembly:
   1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
   2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
   3. Incorporate low leak damper blades for tight airflow shutoff.

E. Hot Water Heating Coil:
   1. Coil Casing: Minimum 22 gage, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
      a. Right or left coil inlets.

2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig.
4. Base performance data on tests run in accordance with AHRI 410and units to bear AHRI 410 label.

F. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

G. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

H. Controls:
1. DDC (Direct-Digital Controls):
a. Include a factory-installed, unit-mounted, direct-digital controller.
b. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
c. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
1) Monitoring and adjusting with portable terminal.
2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
a. Provides accuracy within 5 percent with a 90 degree sheet metal elbow directly at the inlet of the assembly.
b. Control tubing is protected by grommets at the wall of the air flow sensor's housing.
c. Provide sensor with a pressure transducer to interface with a DDC system.
d. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Support units individually from structure in accordance with SMACNA (SRM).

D. Do not support from ductwork.

E. Connect to ductwork in accordance with Section 23 31 00.

F. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum scheduled percent full flow.

3.04 CLEANING

A. Vacuum clean coils and inside of units.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers:

B. Registers/grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Ceiling-mounted, supply register/grilles.

C. Louvers:

1.02 REFERENCE STANDARDS

A. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2015.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 SQUARE PLAQUE FACE CEILING DIFFUSERS

A. Manufacturers:
   1. Titus; Model OMNI.
   2. Price Industries; Model SPD.
   3. Nailor Industries; Model UNI.

B. Type: Provide square diffuser with steel backpan and inner plaque assembly with discharge air in 360 degree pattern.

C. Connections: Round.

D. Frame: Provide inverted T-bar type. In plaster ceilings, provide plaster frame and ceiling frame.

E. Fabrication: Steel with baked enamel finish.

F. Color: As selected by Architect/Engineer from manufacturer's standard range.

G. Accessories: Provide radial opposed blade volume control damper; removable inner plaque assembly with damper adjustable from diffuser face.

2.02 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Manufacturers:
   1. Titus; Model 50F.
   2. Price; Model 80.
   3. Nailor; Model 61EC.

B. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

C. Fabrication: Grid core consists of steel with baked enamel finish.

D. Color: To be selected by Architect/Engineer from manufacturer's standard range.

E. Frame: Channel lay-in frame for suspended grid ceilings.

2.03 LOUVERS

A. Manufacturers:
   1. Ruskin Company; Model ELF6375DX.
   2. Greenheck.
   3. Pottorff.

B. Fabrication:
   1. Design: Stationary drainable louver type with drain gutters in each blade and head with downspouts in jambs and mullions with all welded construction. Hidden vertical supports to allow continuous line appearance up to 120 inches. Steeply angled integral sill.
   2. Frame:
      a. Frame Depth: 6 inches.
      b. Wall Thickness: 0.081 inch, nominal.
      c. Material: Extruded aluminum, Alloy 6063-T6.
   3. Blades:
      a. Style: Drainable. 37.5 degrees at 5-29/32 inches (150 mm), nominal.
      b. Wall Thickness: 0.081 inch, nominal.
      c. Material: Extruded aluminum, Alloy 6063-T6.
   4. Minimum Assembly Size: 12 inches wide by 12 inches high.
   5. Maximum Factory Assembly Size: Single sections shall not exceed 120 inches wide by 90 inches high or 90 inches wide by 120 inches high. Louvers larger than the maximum single size shall be require field assembly of smaller sections.
   6. Recycled Content: 18% post-consumer. 55% pre-consumer, post-industrial. 73% total by weight.

C. Performance Data:
   1. Based on testing 48 inch x 48 inch size unit in accordance with AMCA 500.
   2. Free Area: 57 percent, nominal.
   3. Free Area Size: 9.08 square feet.
   4. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 1,023 feet per minute free area velocity when tested for 15 minutes.

D. Finish:
   1. Finish: 50 percent PVDF: Finish shall be applied at 1.2 mil total dry film thickness.

a. Coating shall conform to AAMA 2604, sections 4.2 and 4.3. Apply coating following cleaning and pretreatment. Cleaning: AA-C12C42R1X.
   1) Baked enamel (50% PVDF).
b. 20-year finish warranty.

2. Color: To be selected by Architect from manufacturer's standard range.

E. Mounting: Furnish with screw holes in jambs for installation.

F. Accessories:
1. Bird Screen:
   a. Aluminum: Aluminum, 5/8 inch by 0.040 inch, expanded and flattened. Frame: Removable.
2. Insect Screen.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. 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.

END OF SECTION

SECTION 23 73 15
SEMI CUSTOM INDOOR CENTRAL-STATION AIR HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Indoor Air Handling Units.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical Characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA /ANSI Standard 204: Balance Quality and Vibration Levels for Fans

C. AMCA 99 - Standards Handbook.

D. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.

G. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

H. ASHRAE Standard 52: Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter

I. ASHRAE/ANSI Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems

J. UL Standard 1995: Heating and Cooling Equipment

K. NFPA 70 - National Electrical Code.

L. UL 723 - Test for Surface Burning Characteristics of Building Materials.

M. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

N. ASTM A-525: Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

O. ASHRAE 90.1 Energy Code.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.

C. Product Data:
   1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.
   2. Provide data of filter media, filter performance data, filter assembly, and filter frames.
   3. Provide manufacturer's installation instructions.
   4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Filters: One set for each unit.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.

1.06 WARRANTY

A. The complete unit shall be covered by a parts warranty issued by the manufacturer covering the first year of operation. This warranty period shall start upon receipt of start-up forms for the unit or eighteen months after the date of shipment, whichever occurs first.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site on factory-furnished shipping skids. Inspect for damage.

C. Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2 PRODUCTS

2.01 AIR HANDLING UNITS

A. Manufacturers:
   1. Nortek.
   2. York.
   3. Daikin.
   4. Trane.

B. General:
   1. Furnish and install where shown on the plans, mechanical frame style air handling units with construction features as specified below. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and

accessories as specified. Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.

C. Factory Test:
   1. Standard Factory Tests: The fans shall be factory run tested to ensure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment.
   2. Cabinet Leak and Deflection Rating:
      a. The cabinet shall be rated at the < 1% @ 8" w.g. L/200.

D. Unit Construction:
   1. General: Provide factory-fabricated air handling units with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service. Units shall be completely assembled. Multiple sectioned units shall be shipped as a single factory assembled piece (except where shipping limitations prevent) de-mounted into modular sections in the field by the contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and AHRI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems." Units shall comply with NFPA 70, "National Electrical Code," as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and maintenance manuals shall be furnished with each unit. Units shall be UL or ETL listed.
   2. Rigging Provision – Multiple Piece Units: Units shipped in multiple sections shall be engineered for field assembly. The base frame shall have integral lifting lugs. The lifting lugs shall be fabricated from steel with an appropriate rigging hole. Lifting lugs shall be located at the corner of each section and sized to allow rigging and handling of the unit. All gasket and necessary assembly hardware shall ship loose with unit. Junction boxes with a factory supplied numbered terminal strip shall be supplied at each shipping split for reconnection of control wiring.
   3. Unit Base - Floor: Unit perimeter base rail shall be fabricated using heavy gauge steel. C-Channel cross supports shall be bolted to perimeter formed steel base and located on maximum 24" centers to provide support for internal components. Base rails shall include lifting lugs at the corner of the unit or each section if de-mounted. Internal walk-on floor shall be 16-gauge galvanized steel. The outer sub-floor of the unit shall be made from 20-gauge galvanized steel
   4. The floor cavity shall be injected spray foam insulated with floor seams gasketed for thermal break and sealed for airtight / watertight construction. Where access is provided to the unit interior, floor openings shall be covered with walk on phenolic coated steel safety grating. Single wall floors with glued and pined insulation and no sub floor are not acceptable. Base frame shall be attached to the unit at the factory.
   5. Unit Casing – The construction of the air handling unit shall consist of a (1" x 2") tube mechanically fastened to formed 20-gauge galvanized steel exterior casing panels. The exterior casing panels shall be attached to the gasketed (1" x 2") tube with corrosion resistant fasteners.

The air handling unit casing shall be of the “no-through-metal” design. The casing shall incorporate insulating modified gasketed thermal breaks as required so that, when fully assembled, there’s no path of continuous unbroken metal to metal conduction from inner to outer surfaces.

6. Double Wall Liner - Each unit shall have double wall construction with 20-gauge solid galvanized liner in the entire unit. The double wall interior panel shall be removable from the outside if the unit without affecting the structural integrity of the unit.
7. Insulation - Entire unit to be insulated with a full (R16) 2” thick injected closed cell foam insulation. Foam shall be ecomate 0-, 0-, (Non-VOC) UL 94HF1 rated. All insulation edges shall be encapsulated within the panel. All field penetrations must be completely sealed by installing contractor. Note: Non-UL 94HF1 rated foam is not allowed.
8. Access Doors - The unit shall be equipped with a solid double wall foam insulated (same as the unit casing), hinged access doors as shown on the plans. The door hinge assembly shall be powder coated steel. There shall be a minimum of two heavy duty handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors.

E. Unit Component Description:
   1. FANS – Direct Drive
      a. The fan shall include direct driven, arrangement 4 plenum fan constructed per AMCA requirements for the duty specified. Class I fans are not acceptable. Fan wheels shall be aluminum construction and rated in accordance with AMCA for performance. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan/motor speed. Each fan/motor assembly shall include a minimum 14 gauge spun steel fan inlet funnel, and a G90 galvanized steel motor support plate and fan base with internal RIS isolation.
      b. All motors shall be standard foot mounted type TEAO or TEFC selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2. Motors shall be as manufactured by Baldor, Siemens, or Toshiba that operate at varying synchronous speeds as driven by an approved VFD. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule(s). Steel cased motors and/or ODP motors are not acceptable. All motors shall include permanently sealed L10-400,000 hr bearings with shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022” per second peak, filter in (.55mm per second peak, filter in).
   2. ECM Fans:
      a. Provide ECMi fans which are high efficiency centrifugal fans with integral ECMi motors. These fans shall have free-running impellers made from composite materials with optimized backward-curved blades, inlet cone, and matched high efficiency ECMi motors. ECMi assemblies shall be dynamically balanced to meet AMCA standard 204, for fan application class BV-4, to meet or exceed a rotational imbalance Grade G2.5, producing a maximum rotational imbalance of 0.10 inches per second peak, filter in. “Filter in”

measurement indicates that the specified balance grade must be achieved at the submitted design operating speed for the fan(s).

b. The ECMi motors shall feature electronically commutated permanent magnet motors with the following features:
   1) UL listed brushless permanent magnet motors
   2) Bearings shall be permanently lubricated
   3) L10 design life of 100,000 hours
   4) Integral no-maintenance means of shaft isolation to prevent electrical arcing across bearings
   5) Motor shall feature internal monitoring circuits to detect and protect the motors from over current and over temperature conditions
   6) Motors shall meet IP54 protection and thermal class THCL 155
   7) Bacnet communication.
   8) Furnish with 0-10V control by others.

3. Heat Transfer Coils - Water Coil:
   a. All coil assemblies shall be leak tested under water at 315 PSIG and PERFORMANCE is to be CERTIFIED under AHRI Standard 410. Coils exceeding the range of AHRI standard rating conditions shall be noted.
   b. Cooling coils shall be mounted on stainless steel support tubes above the drain pan. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downspout. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins are die formed Plate type.
   c. Headers are to be seamless copper with die formed tube holes.
   d. Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided on coil header for coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 250 PSIG working pressure. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter.
   e. Water coils shall have the following construction:
      1) Standard 1/2":
      2) 1/2" o.d. x .017" wall copper tube with .025 return bends
      3) .006" aluminum fins
   f. 16-gauge galvanized steel casing
4. Condensate / Drain Pans - IAQ style drain pans shall be provided under all cooling coils as shown on the drawings. The drain pan shall be fabricated from 16-gauge 304 stainless steel. All pans are to be double pitched for complete drainage with no standing water in the unit. They shall be insulated minimum 2-inch "Double Bottom" construction with welded corners. Provide stainless steel, 1” MPT drain connection extended to the exterior of the unit base rail. All drain connections shall be piped and trapped separately for proper drainage.
5. Filters - Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. Face loaded pre and final filters shall have Type 8 frames as manufactured by AAF, FARR or equal. Side service filter sections shall include hinged access doors on both sides of the unit. Internal blank-offs shall be provided by the air unit manufacturer as required to prevent air bypass around the filters. The filters shall be

as manufactured by Farr, Purolator, AAF or equal. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters.

a. Angle Racks - Filter racks shall be completely factory assembled and designed for industrial applications. Angle racks shall be fabricated from no less than 16-gauge galvanized steel. Angle racks shall be applied in low efficiency filter applications and will be upstream accessible. Upstream access filter racks shall have one central access cover per row of filters, centered in the unit for easy access. Filter racks shall be designed for a maximum of 500 fpm or meet or exceed the area specified by the mechanical schedule.
b. Medium Efficiency Pleated Filters - Filters shall be 2" thick, 30% efficient. Filter media shall be 100% synthetic. The filter shall have an average efficiency of 25 30% and an average arrestance of 90 92%. The filters shall be listed as Class II under UL Standard 900. Filters shall be tested per ASHRAE Standard 52-76. The effective media shall not be less than 4.6 square feet of media per 1.0 square foot of filter face area and shall contain not less than 15 pleats per linear foot. Initial resistance at 500 fpm approach shall not exceed 0.28” wg.
c. Dampers – Ruskin CD-60 or approved equal. Provide Class 1 rated, ultra-low leak dampers (less than 3 cfm/sq ft. @ 1” w.g.) as indicated on the unit drawings. Low leakage dampers shall have extruded aluminum airfoil blades. Flat or formed metal blades are not acceptable. The damper blade shall incorporate santoprene rubber edge seals and zinc plated or stainless-steel tubular steel shaft for a non-slip operation. Shaft bearings shall be spherical – noncorrosive nylon to eliminate friction and any metal-to-metal contact. Damper jamb seals shall be UV rated, nylon glass reinforced, or stainless-steel spring arcs designed for a minimum air leakage and smooth operation. Damper linkage shall be concealed within a 16-gauge galvanized steel frame.

F. Electrical Power and Controls:
1. All electrical and automatic control devices not previously called out or listed below are to be furnished and installed in the field by OTHERS.
a. All wiring shall be (75°C) Insulated copper wires.
b. The unit shall feature a mounted permanent nameplate displaying at a minimum the manufacturer, serial number, model number and current and amps voltage. The unit must have an ETL or UL Listing and bear the appropriate mark.
c. Conduit shall consist of a combination of EMT, or flexible metal conduit as required. Liquidtite flexible metal conduit may be used outside the air tunnel for wet locations.
d. The fan motor shall be wired to a junction box mounted on unit exterior.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's Installation & Maintenance instructions.

3.02 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

3.03 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of 4 of training.
   3. Location: At project site.

3.04 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit heaters.

1.02 RELATED REQUIREMENTS

A. Section 23 07 19 - HVAC Piping Insulation.

B. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

C. Section 23 21 13 - Hydronic Piping.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Manufacturer's Instructions: Indicate installation instructions and recommendations.

D. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 HYDRONIC UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company.

2. Sterling Hydronics, a Mestek Company.
3. Rittling.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Perform factory run test under normal operating conditions, water, and steam flow rates.

D. Casing: Minimum 18 gage, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gage, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.

E. Finish: Factory applied baked enamel of color.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

G. Air Outlet: Adjustable pattern diffuser on vertical projection models and two way louvers on horizontal projection models.

H. Totally Enclosed Motors: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

I. Accessories:
1. Proivde with fingerproof fan guard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Do not damage equipment or finishes.

C. Unit Heaters:
1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements and materials specifically applicable to Division 26 Sections. Section includes:
   1. Electrical Identification.
   2. Minor Demolition.
   3. Conductors and Devices.
   4. Raceways and Boxes.
   5. Supporting Devices.

1.02 REGULATORY REQUIREMENTS

A. Conform to construction standards as adopted by the Illinois Community College Board to include:
   1. International Building Code - 2018 Edition.
   2. National Electrical Code ANSI/NFPA 70 - 2020 Edition.
   3. Life Safety Code NFPA 101 - 2018 Edition.
   4. Fire Prevention and Safety - 41ILCS100.

B. Conform to building codes as adopted by the local authority having jurisdiction, where applicable.

C. Install electrical Work in accordance with the NECA Standard of Installation.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store and protect all materials as specified under the provisions of Section 01 60 00 and as specified herein.

B. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

C. Ship products to the job site in their original packaging. Receive and store products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.

D. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

1.04 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions. Drawings have omitted certain branch circuitry in areas for ease of reading. All branch circuitry is to be provided by Contractor.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission from Architect/Engineer before proceeding as specified under modification procedures.

1.05 QUALITY ASSURANCE

A. Provide Work as required for a complete and operational electrical installation.

B. All products shall be designed, manufactured, and tested in accordance with industry standards. Standards, organizations, and their abbreviations as used hereafter, include the following:
   1. American National Standards Institute, Inc (ANSI).
   2. American Society for Testing and Materials (ASTM).
   3. National Electrical Manufacturers Association (NEMA).
   4. Underwriters Laboratories, Inc. (UL).

C. Install all Work in accordance with the NECA Standard of Installation.

1.06 SUBMITTALS

A. Submit all requested items in Division 26 Sections under provisions of Section 01 30 00.

1.07 SUBSTITUTIONS

A. Substitutions will be considered only as allowed within the provisions of Section 01 60 00.

1.08 PROJECT RECORD DOCUMENTS

A. Cooperate and assist in the preparation of project record documents under the provisions of Section 01 78 00.

1.09 TRENCHING, FILL AND COMPACTION

A. Provide trenching, fill and compaction for all work indicated on Drawings and specified in Division 26 sections.

1.10 PROJECT MANAGEMENT AND COORDINATION

A. Proper project management and coordination is critical for a successful project. Manage and coordinate the Work with all other trades in accordance with Section 01 30 00 requirements. Reliance on the Drawings and Specifications only for exact project requirements is insufficient for proper coordination.

PART 2 PRODUCTS

2.01 WIRING METHODS

A. All locations: Building wire in raceway.

B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
   1. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet. Use minimum #10 AWG conductor wire in all the following locations:
      a. All programmable panel branch circuits (larger where indicated).
      b. All emergency lighting and exit branch circuits.

2.02 WIRE AND CABLE

A. Manufacturers:
   1. Okonite.
   2. Southwire.
   3. Collyer.

B. Building Wire:

1. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation.
2. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, stranded conductor (solid for device terminations).
3. Control Circuits: Copper, stranded conductor, 600 volt insulation.
4. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
5. Use conductor not smaller than 12 AWG for power and lighting circuits.
6. Use conductor not smaller than 16 AWG for control circuits.

C. Locations:
1. Concealed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
2. Exposed Dry Interior Locations: Use only building wire with Type THHN insulation in raceway.
3. Above Accessible Ceilings: Use only building wire with Type THHN insulation in raceway.
4. Wet or Damp Interior Locations: Use only building wire with Type THWN insulation in raceway.
5. Exterior Locations: Use only building wire with Type XHHW insulation in raceway.

2.03 WIRING DEVICES AND WALL PLATES

A. Duplex Convenience Receptacle: Nema 5-20R, duplex, specification grade.
1. Hubbell.
2. Bryant.
3. Leviton.
4. Color: Ivory.

2.04 RACEWAY REQUIREMENTS

A. Use only specified raceway in the following locations:
1. Branch Circuits and Feeders:
a. Concealed Dry Interior Locations: Electrical metallic tubing.
b. Exposed Dry Interior Finished Locations: Electrical metallic tubing.
c. Exposed Dry Interior Unfinished Locations: Electrical metallic tubing.
d. All other locations: Galvanized Rigid Metallic Conduit.

B. Size raceways for conductor type installed.
1. Minimum Size Conduit Homerun to Panelboard: 3/4-inch.

2.05 METALLIC CONDUIT AND FITTINGS

A. Conduit:
1. Rigid Steel Conduit: ANSI C80.1.
2. Electrical metallic tubing: ANSI C80.3.
3. Flexible Conduit: UL 1, zinc-coated steel.
a. Liquidtight Flexible Conduit: UL360. Fittings shall be specifically approved for use with this raceway.

B. Conduit Fittings:
1. Metal Fittings and Conduit Bodies: NEMA FB 1.
a. EMT fittings: Use set-screw indentor-type fittings.

2.06 CONDUIT HANGERS

A. Manufacturers:
   1. Minerrallac Electric Company.
   2. Substitutions: Or Approved Equal.

B. Description:
   1. Standard conduit hanger, zinc-plated steel with bolts.
   2. Threaded rod and hardware: Plated finish, size and length as required for loading and conditions.

2.07 BEAM CLAMPS

A. Manufacturers:
   1. Appleton.
   2. Midwest.
   3. Raco.

B. Description: Malleable beam clamp, zinc plated steel.

2.08 ELECTRICAL BOXES

A. Manufacturers:
   1. Raco.
   2. Steel City.
   3. Appleton.
   4. Substitutions: Or Approved Equal.

B. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel, suitable for installation in masonry:

C. Equipment Support Boxes: Rated for weight of equipment supported; include 2 inch male fixture studs where required.

D. Wet Location Outlet Boxes: Cast aluminum: Cast alloy, deep type, gasket cover, threaded hubs.

2.09 PENETRATION SEALANTS

A. Fire-rated assemblies: Provide firestopping of all penetrations made by Work.

B. Thermal and Moisture Protection: Provide thermal and moisture protection made by Work.

2.10 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:
   1. Each electrical distribution and control equipment enclosure.

C. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads.
   2. Use 1/4 inch letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on a black background. Use only for identification of individual wall switches and receptacles and control device stations.

2.11 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Brady Model PCPS.
   2. Panduit Model PCM.
   3. T & B Model WM.

B. Description: Cloth type wire markers.

C. Locations: Each conductor at panelboard gutters, pull boxes, and each load connection.

D. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Demolition Drawings are based on casual field observation and are intended to identify the limits of the construction site. Remove all electrical systems in their entirety in proper sequence with the Work.

B. Disconnect electrical systems in walls, floors, and ceilings for removal.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Beginning of demolition means installer accepts existing conditions.

E. Verify that supporting surfaces are ready to receive work.

F. Electrical boxes are shown on Drawings, in approximate locations, unless dimensioned.
   1. Obtain verification from Architect/Engineer for locations of outlets throughout prior to rough-in.

G. Degrease and clean surfaces to receive wire markers.

H. Verify that interior of building is physically protected from weather.

I. Verify that mechanical work which is likely to injure conductors has been completed.

J. Completely and thoroughly swab raceway system before installing conductors.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove all existing electrical installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Relocate existing fire alarm devices affected by wall, ceiling and floor demolition.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

3.03 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

E. Neatly train and secure wiring inside boxes, equipment, and panelboards.

F. Route wire and cable as required to meet project conditions.
   1. Wire and cable routing indicated is approximate unless dimensioned.
   2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

G. Pull all conductors into raceway at same time.

H. Protect exposed cable from damage.

I. Neatly train and lace wiring inside boxes, equipment and panelboards.

J. Support cables above accessible ceilings to keep them from resting on ceiling tiles.

K. Make splices, taps, and terminations to carry full ampacity of conductors without perceptible temperature rise.

L. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

M. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

N. Do not use powder-actuated anchors.

O. Do not drill or cut structural members.

P. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

Q. Install surface-mounted cabinets and panelboards with minimum of four anchors.

R. Terminate spare conductors with electrical tape.

S. Install wiring devices in accordance with manufacturer's instructions.
   1. Install wall switches at height shown on drawings, OFF position down.
   2. Install convenience receptacles at height shown on drawings grounding pole on bottom.
   3. Install specific purpose receptacles at heights shown on Drawings.

T. Install wall plates flush and level.
   1. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
   2. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

END OF SECTION

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment and devices not an integral part of the electrical distribution system.

1.02 RELATED REQUIREMENTS

A. Section 26 05 00 - Basic Electrical Requirements

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Provide conduit rough-in and electrical connection to powered equipment and devices identified in the Project Manual and on the Drawings. Refer specifically, but not limited to, these Specification Sections for further information:
   1. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
   2. Section 23 09 23 - Direct-Digital Control System for HVAC.
   3. Section 23 21 23 - Hydronic Pumps.
   4. Section 23 34 23 - HVAC Power Ventilators.
   5. Section 23 73 15 - Semi Custom Indoor Central-Station Air Handling Units.
   6. Section 23 82 00 - Convection Heating and Cooling Units.
   7. Section 26 05 00 - Basic Electrical Requirements.

B. Coordination: Determine connection locations and requirements for furniture, equipment and devices furnished or provided under other sections.
   1. Do not rely solely on the Drawings and Project Manual for execution of the Work of this Section.
   2. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions.
   3. Include necessary field evaluation time to inspect connection requirements.
   4. Coordinate with other trades to determine exact rough-in requirements.

C. Sequencing:
   1. Install rough-in of electrical connections before installation of furniture and equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

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. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

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.

END OF SECTION

SECTION 26 51 00
INTERIOR LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Luminaire accessories.

1.02 REFERENCE STANDARDS

A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

N. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

O. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect/Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Provide photometric calculations where luminaires are proposed for substitution upon request.
   2. Indicate construction, installation and mounting details for products.
   3. Wiring Diagrams: Submit wiring diagrams for all exit sign, night light, self-contained back-up battery lighting, battery ballasts and associated circuit breakers, programmable circuit breakers and/or emergency circuit breakers.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

F. Examine substrate and supporting grids for luminaires.

G. Examine each fixture to determine suitability for lamps specified.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

F. Install wall mounted luminaires, emergency units and exit signs at height as indicated on Drawings and directed in the field by Architect. Obtain final approval from Architect prior to commencement of this portion of work.

G. Install accessories furnished with each luminaire.

H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

I. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Support luminaires larger than 2 foot by 4 foot size independent of ceiling framing.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

J. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   3. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

O. Install lamps in each luminaire.

P. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect/Engineer.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect/Engineer or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect/Engineer or authority having jurisdiction.

D. Relamp luminaires which have failed lamps at completion of work.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of luminaires to Architect/Engineer, and correct deficiencies or make adjustments as directed.

C. Just prior to Substantial Completion, replace all lamps that have failed.

D. Project record documents: Accurately record location of each luminaire.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide new strobe in mechanical room.

A. Provide new duct detector and area detector at unit AHU-1.

B. Provide fire safety control function - fan shut down.

C. Maintenance of fire alarm system under contract for specified warranty period.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities; 2016.

D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 601 - Standard for Security Services in Fire Loss Prevention; 2015.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Shop Drawings: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Shop drawing submitted to Architect/Engineer shall be approved and signed by the authority having jurisdiction.
   2. Submit field wiring color-coding legend.
   3. Indicate existing wiring arrangements and locations of devices and wiring routing.
   4. Copy (if any) of list of data required by authority having jurisdiction.
   5. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   6. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   7. System zone boundaries and interfaces to fire safety systems.
   8. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   9. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   10. List of all devices on each signaling line circuit, with spare capacity indicated.

11. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, circuit length limitations, dimensions, ratings, layouts and complete catalog numbers.
    a. Submit UL listings with cross-listing substantiation for each system component clearly marked.
12. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
13. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
14. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
15. Certification by Contractor that the system design complies with the contract documents.
16. Do not show existing components to be removed.

D. Evidence of installer qualifications.

E. Evidence of instructor qualifications; training lesson plan outline.

F. Evidence of maintenance contractor qualifications, if different from installer.

G. Inspection and Test Reports:
    1. Submit inspection and test plan prior to closeout demonstration.
    2. Submit documentation of satisfactory inspections and tests.
    3. Submit NFPA 72 "Inspection and Test Form," filled out.

H. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
    1. Complete set of specified design documents, as approved by authority having jurisdiction.
    2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
    3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
    4. List of recommended spare parts, tools, and instruments for testing.
    5. Replacement parts list with current prices, and source of supply.
    6. Detailed troubleshooting guide and large scale input/output matrix.
    7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
    8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

I. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
    1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
    2. "As installed" wiring and schematic diagrams, with final terminal identifications.
    3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

J. Closeout Documents:

1. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.04 QUALITY ASSURANCE

A. Designer: Qualified employee of fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
   1. Delegated Engineering Responsibility: Provide design services necessary to modify initiating device circuits, notification circuits and affected control panels and power supplies. Provide all necessary drawings and specification to local authority having jurisdiction for approval to modify this existing system as intended.

B. Installer: Qualified firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

E. Qualified personnel includes those persons that are:
   1. Factory trained and certified; OR
   2. NICET Level III or IV (3 or 4) Fire Alarm certified; OR
   3. International Municipal Signal Association Fire Alarm certified; OR
   4. Certified by state (Illinois Department of Professional Regulation); OR
   5. Trained, qualified, and employed by an organization listed by a national testing laboratory.

1.05 EXISTING CONDITIONS

A. The existing fire alarm system control panel is an Edwards EST3 Addressable System.
   1. Provide new equipment compatible with existing devices and system at site.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Areas denoted on the drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the local authority having jurisdiction which is City of Joliet.

c. Applicable local codes.
d. The contract documents (drawings and specifications).
e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises (existing).
5. Zoning: Point addressable system with initiating devices being individually zoned.
6. Existing Control Panel: Make modifications to the existing panel: relocate fan shut down control function.

B. Supervising Stations and Fire Department Connections:
1. Existing connections to remain.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.02 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Existing to remain,

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Existing to remain. Modify MAU-3 fan shut down fire control function. Existing.

C. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Power Supplies, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Initiating Devices:
   1. Smoke Detectors: Addressable photoelectric smoke detector compatible with control panel. Each sensor shall be capable of being set at four sensitivity settings. Velocity rated to match air flow.
      a. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke.
      b. Sensor shall have two LED visual indicators providing local 360 degree visibility of operating status and alarm indication. The LED shall pulse periodically indicating the sensor is receiving power and communication is being supplied.
      c. Each sensor shall allow for the setting of two different sensitivity levels. These two levels shall be capable of being programmed with different sensitivities for occupied and unoccupied mode. This feature shall also incorporate programmable weekend days, where the sensor remain at an unoccupied sensitivity level all day.
      d. Each sensor screen and cover shall be easily removable for field cleaning. Wire connections shall be made by clamping plate and screw.
      e. Detector shall be a two-piece head and base unit.
   2. Duct Mounted Smoke Detector: Addressable/Analog photoelectric type, duct sampling tubes extending width of duct, in duct-mounted housing compatible with control panel and air stream velocities. Fan control shall not be hard wired through duct detector. Fan shutdown shall be completed by fan shutdown relay.

D. Notification Appliances:
   1. Strobes: NFPA 72 and UL 1971; electronic horn rated 90 dBA average at 10 feet. Provide integral 110 candela strobe lamp and flasher. Provide red trim ring for semi-flush mounting. Synchronize strobes within site of each other. Compatible with control panel.

E. Circuit Conductors: Copper; provide 200 feet extra; color code and label.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Field inspect existing fire alarm system installation to determine all required interface components necessary for fire alarm system replacement and relocation.

3.02 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Install fire alarm system in accordance with manufacturer's instructions.

C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

D. Obtain Owner's approval of locations of devices, before installation.

E. Install instruction cards and labels.

3.03 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

END OF SECTION