PROJECT SPECIFICATIONS

MARYLAND STADIUM AUTHORITY
M&T BANK STADIUM
1101 RUSSELL STREET
BALTIMORE, MD 21230

STADIUM OPERATIONS OFFICES RENOVATION

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REBID SET
JANUARY 23, 2019

MARYLAND STADIUM AUTHORITY
M&T BANK STADIUM
1101 RUSSELL STREET
BALTIMORE, MD 21230
STADIUM OPERATIONS OFFICES RENOVATION

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DIVISION 1 – GENERAL REQUIREMENTS

SECTION 011000 -- SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

2. Division 01 Section “Construction Indoor Air Quality” for procedures and documentation governing indoor air quality

3. Division 01 “Construction Waste Management and Disposal” for procedures and documentation governing disposal and recycling of construction waste.

4. Division 01 “Project Requirements” for product purchasing requirements to meet the Owner’s Sustainable Purchasing Policy

1.2 PROJECT INFORMATION

A. Project Identification: Oriole Park at Camden Yards Lower Level Warehouse Office Renovation.

1. Project Location: 1101 Russell Street, Baltimore, MD 21230.

B. Owner: Maryland Stadium Authority.

1. Owner's Representative: Anthony Pruner – apruner@mdstad.com – (410) 329-3100

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
a. The Project consists of renovations to approximately 3,000sf of existing office space on the service level of M&T Bank Stadium. An existing storage room and A/V shop will be renovated to create additional office spaces for the use of the

Maryland Stadium Authority Football Operations (OPS) department. Existing finishes in existing OPS suite spaces will be replaced.

b. The Project is in a LEED-accredited (EBOM) building, the Work for the Project must comply with the building's established Indoor Air Quality Management Program, Sustainable Purchasing Policy, and Solid Waste Management Policy. These specifications outline certain procedures and goals within the established policies that must be followed and met. These specifications also describe the documentation that must be submitted to the Owner upon completion of the Work to prove compliance with the policies. This renovation is not seeking it's own LEED accreditation.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in a single phase.

B. Before commencing Work, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all Work activities including time for move-out and move-in of Users.

1.5 WORK UNDER SEPARATE CONTRACT

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Follow Work: Owner will let separate contract(s) for the following operations at Project site:

1. Furnish and installation of CATV cabling

1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to designated areas of the lower level.
2. Driveways, Walkways and Entrances: Keep driveways, loading areas**,** and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries in accordance with the Building Schedule.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather-tight condition throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than **72** hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Owner will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless scheduled otherwise with the Owner.

1. Construction activities generating noise, vibration or dust shall be coordinated and scheduled with the Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than **one week** in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than **one week** days in advance of proposed disruptive operations.
2. Obtain **Owner's** written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

F. Controlled Substances: Use of tobacco products and other controlled substances in the existing building and on the project site is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's

letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Owner's Action: If necessary, Owner will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Owner will notify Contractor of acceptance or rejection of proposed substitution within **15** days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Written approval of Owner.

b. Use product specified if Owner does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Owner will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution will not adversely affect Contractor's construction schedule.

c. Requested substitution has received necessary approvals of authorities having jurisdiction.

d. Requested substitution is compatible with other portions of the Work.

e. Requested substitution has been coordinated with other portions of the Work.

f. Requested substitution provides specified warranty.

g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Owner will consider requests for substitution if received within 15 days after the Notice of Award.

1. Conditions: Owner will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

A. Owner will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time**.**

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Owner will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Owner are not instructions either to stop work in progress or to execute the proposed change.
2. Within 5 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Owner.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Owner may issue a Construction Change. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Owner at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Contractor's name and address.
c. Date of submittal.

2. Arrange schedule of values consistent with format of **AIA Document G703**
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project

Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Submit Application for Payment to Owner by the 24th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

C. Application for Payment Forms: Use AIA Documents G702 and G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Owner by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.

H. Application for Payment at Substantial Completion: After Owner issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. MBE Documents supplied by MSA. See attached, contractor to complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project meetings.

B. Related Requirements:

1. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Owner indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Owner will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Owner will return RFIs submitted to Owner by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. RFI number, numbered sequentially.
6. RFI subject.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Owner's Action: Owner will review each RFI, determine action required, and respond. Allow **seven** working days for Owner's response for each RFI. RFIs received by Owner after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Owner’s actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. Owner's action may include a request for additional information, in which case Owner's time for response will date from time of receipt of additional information.

3. Owner's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner **seven** days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. RFI number including RFIs that were dropped and not submitted.
4. RFI description.
5. Date the RFI was submitted.
6. Date Architect's response was received.

E. On receipt of Owner's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Owner within **seven** days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, within **three** days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, but no later than seven days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.

e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Preparation of record documents.
l. Use of the premises and existing building.
m. Work restrictions.
n. Working hours.
o. Owner's occupancy requirements.
p. Responsibility for temporary facilities and controls.
q. Procedures for moisture and mold control.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.
v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.

u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct, progress meetings biweekly

1. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. **One** digital copy. Paper copies may be requested by the owner or architect.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

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

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Owner.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than **15** days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Owner's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than **seven** days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.
6. Other Constraints: N/A

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion**.**

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is **seven** or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within **seven** days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.
4. Material deliveries.
5. High & low temperatures & general weather conditions, including presence of rain/snow.
6. Accidents.
7. Meetings and significant decisions.
8. Unusual events.
9. Stoppages, delays, shortages, and losses.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received and implemented.
14. Equipment or system tests and startups.
15. Partial completions and occupancies.
16. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Owner’s responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Owner’s responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Owner and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Owner for Contractor's use in preparing submittals unless specifically requested. If requested, contractor shall be provided release forms for signature. Electronic files will only be released to the contractor after signed copy of forms are received by architect or engineer. **Build time into submittal production and review schedule to reflect this requirement.**

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Owner has the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Owner's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow **10** days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow **10** days for review of each resubmittal.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Owner.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

a. Project name.
b. Date.
c. Name of Contractor.
d. Name of firm or entity that prepared submittal.
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Specification paragraph number or drawing designation and generic name for each of multiple items.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Related physical samples submitted directly.

m. Indication of full or partial submittal.
n. Transmittal number, numbered consecutively.
o. Submittal and transmittal distribution record.
p. Other necessary identification.
q. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

E. Paper Submittals: Where Electronic Submittals are impractical or inappropriate, place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Owner.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Contractor.
d. Name of subcontractor.
e. Name of supplier.
f. Name of manufacturer.
g. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.
j. Location(s) where product is to be installed, as appropriate.
k. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Owner observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Owner will return without review submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).

5) Name of Contractor.
6) Name of firm or entity that prepared submittal.
7) Names of subcontractor, manufacturer, and supplier.
8) Category and type of submittal.
9) Submittal purpose and description.
10) Specification Section number and title.
11) Specification paragraph number or drawing designation and generic name for each of multiple items.
12) Drawing number and detail references, as appropriate.
13) Indication of full or partial submittal.
14) Transmittal number**,** numbered consecutively.
15) Submittal and transmittal distribution record.
16) Remarks.
17) Signature of transmitter.

F. Options: Identify options requiring selection by Owner.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Owner’s action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Owner's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

a. Owner will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit electronic copy of each submittal unless otherwise indicated. Owner will return annotated file.
3. Informational Submittals: Submit electronic copy of each submittal unless otherwise indicated. Owner will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be

signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit **one** full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Owner will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit **three** sets of Samples. Owner will retain **two** sample sets; remainder will be returned

        1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least **three** sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawings Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: **Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner.**

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 OWNER”S ACTION

A. General: Owner will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Owner will review each submittal, make marks to indicate corrections or revisions required, and return it. Owner will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. Approved: Submittal is accepted and can be incorporated into the work.

2. Approved as Notes: Submittal is conditionally accepted subject to inclusion of items noted.

3. Revise and Resubmit: Submittal in not accepted and must be resubmitted.

4. Rejected: Submittal in unacceptable

C. Informational Submittals: Owner will review each submittal and will not return it, or will return it if it does not comply with requirements. Owner will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 013520 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1. Division 01 Section “Construction Indoor Air Quality” for procedures and documentation governing indoor air quality

2. Division 01 “Construction Waste Management and Disposal” for procedures and documentation governing disposal and recycling of construction waste.

3. Division 01 “Project Requirements” for product purchasing requirements to meet the Owner’s Sustainable Purchasing Policy

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with select MSA Sustainability Policies needed for Building to maintain LEED Gold certification based on the USGBC's "LEED for Existing Buildings and Operations Management." NOTE: This project is not seeking it's own LEED accreditation.

1. Other requirements needed to maintain LEED certification depend on product selections and may not be specifically identified as sustainable policy requirements. Compliance with requirements needed to maintain LEED certification may be used as one criterion to evaluate substitution requests and comparable product requests.
2. Specific requirements for Sustainability Policies are also included in other Sections.

1.3 DEFINITIONS

A. Agrifiber Products: Composite panel products derived from agricultural fiber.

B. Composite Wood: A product consisting of wood fiber or other plan particles bonded together by resin or binder.

C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Division 01 section Construction Waste Management.

D. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible

photochemical reactivity, listed in EPA 40 CFR 51.100(s) are also excluded from this regulatory definition.

E. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles (800 km) from Project site. Manufacturing refers to the final assembly of components into the building product that is installed at Project site.

F. Regionally Extracted and Manufactured Materials: Regionally manufactured materials made from raw materials that are extracted, harvested, or recovered within a radius of 500 miles (800 km) from Project site.

G. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the MSA regarding Sustainabilty Policy requirements that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the closeout of the project. Document responses and include them in the close out documents.

1.5 ACTION SUBMITTALS

A. General: Submit additional Sustainability Policy submittals required by other Specification Sections.

B. Sustainability Policy submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated Sustainability Policy requirements.

C. Sustainability Policy Documentation Submittals:

1. Comply with Section 017419 "Construction Waste Management and Disposal."
2. Comply with Section 016000 "Product Requirements."
    a. Product data and certification letter from product manufacturers indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating material costs for each product having recycled content.
    b. Product data indicating location of material manufacturer for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material and for each regionally extracted and manufactured material.

c. Include statement indicating distance from manufacturer to Project for each regionally manufactured material.
d. Include statement indicating location of and distance from Project to point of extraction, harvest, or recovery for each raw material used in regionally extracted and manufactured materials.
e. Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
f. Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
g. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

3. Comply with Section 015060 "Construction Indoor Air Quality"

a. Construction indoor-air-quality management plan.
b. Product data for temporary filtration media.
c. Product data for filtration media used during occupancy.
d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
e. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
f. Product data for filtration media used during flush-out and during occupancy.
g. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Furniture.
2. Plumbing.
3. Mechanical.
4. Electrical.
5. Paints and Sealants.
6. Wood-based construction materials.

B. Sustainability Policy Action Plans: Provide preliminary submittals within seven days of date established for commencement of the Work indicating how the following requirements will be met:

1. Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
2. Sustainable Purchasing Plan complying with Section 016000 “Product Requirements”
3. Construction indoor-air-quality management plan complying with Section 015060 “Construction Indoor Air Quality”.

1.7 QUALITY ASSURANCE

A. Sustainability Policy Manager: The Contractor shall designate one person to coordinate Sustainability Policy requirements.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to comply with Sustainability Policies and maintain the building's LEED accreditation. Although other Sections may specify some requirements that contribute to Sustainability Policy compliance, the Contractor shall determine additional materials and procedures necessary to comply with Sustainability Policies.

2.2 RECYCLED CONTENT OF MATERIALS

A. Furniture shall have recycled content such that post-consumer recycled content constitutes a minimum of 10 percent of cost of furniture purchased for the project **OR** post-industrial recycled content for Project constitutes a minimum of 20 percent of cost of furniture purchased for Project.

1. Cost of post-consumer recycled content or post-industrial recycled content shall be determined by dividing weight of post-consumer or post-industrial recycled content in the item by total weight of the item and multiplying by cost of the item.

B. This requirement may be achieved instead of the requirements listed in paragraph 2.3 of this section.

2.3 REGIONAL MATERIALS

A. Furniture shall not contain less than 50 percent of materials (by cost) which are harvested and process or extracted and processed regionally.

B. This requirement may be achieved instead of the requirements listed in paragraph 2.2 of this section.

2.4 LOW-EMITTING MATERIALS

A. For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the VOC content limits of SCAQMD Rule #1168 and Bay Area Air Quality Management District Regulation 8, Rule 51

B. For field applications that are inside the weatherproofing system, paints and coatings shall comply with the VOC content limits of Green Seal's Standard GS-11 requirements.

C. Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

D. Non-carpet finished flooring is FloorScore-certified.

PART 3 - EXECUTION

3.1 REFRIGERANT REMOVAL

A. Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections. Refer to mechanical specifications for additional information.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 017419 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

A. Comply with Section 015060 "Construction Indoor Air Quality."

3.4 SUSTAINABLE PURCHASING

A. Comply with Section 016000 “Product Requirements”

END OF SECTION 013520

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

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

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

1.3 ABBREVIATIONS AND ACRONYMS

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

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute

AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	Association of the Wall and Ceiling Industry
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association

BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation)
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CRRC	Cool Roof Rating Council
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet and Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau

CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FMRC	Factory Mutual Research (Now FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association

	(Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation (Now BWF)
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization Available from ANSI
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA (Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)

MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)

NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)
NWWDA	National Wood Window and Door Association (Now WDMA)
OPL	Omega Point Laboratories, Inc. (Now ITS)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC	Safety Glazing Certification Council

SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc. (Now TCNA)
TCNA	Tile Council of North America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council

USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

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

IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
ICC-ES	ICC Evaluation Service, Inc.
UBC	Uniform Building Code (See ICC)

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

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency

FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Buildings Service (See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service (See USDA)
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

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

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board
CFR	Code of Federal Regulations Available from Government Printing Office
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point
DSCC	Defense Supply Center Columbus (See FS)

FED-STD	Federal Standard (See FS)
FS	Federal Specification Available from Department of Defense Single Stock Point
	Available from Defense Standardization Program
	Available from General Services Administration
	Available from National Institute of Building Sciences
FTMS	Federal Test Method Standard (See FS)
MIL	(See MILSPEC)
MIL-STD	(See MILSPEC)
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point
UFAS	Uniform Federal Accessibility Standards Available from Access Board

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Owner testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

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

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

C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Wood Enclosure Fence: Plywood, **6 feet** high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

2.2 TEMPORARY FACILITIES

A. Owner will provide meeting space for project meetings specified in other Division 01 Sections.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

A. General: Connect to existing service.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Heating and Cooling: With above protect the use of the existing heating and cooling is permitted during construction activities for curing or drying of completed installations or for

protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
1. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Telephone Service: Provide Owner with list of all telephone numbers for Contractor and sub Contractors including main office and cell numbers for on site staff.

3.2 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Project Signs: Unauthorized signs are not permitted.
1. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Existing Elevator Use: Coordinate with Owner for possible limited use of existing elevators. If permitted, elevators must be kept clean and maintained in a condition acceptable to Owner.

1. Do not load elevators beyond their rated weight capacity.

2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

G. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to Maryland Department of the Environment.

D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

F. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration, to separate areas occupied by Owner and tenants from fumes and noise, and to protect Owner equipment to remain in place throughout construction from dust, debris, & damage.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
5. Protect existing fire-suppression sprinkler systems from construction activities and to prevent accidental discharge.

3.4 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged and wet material.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01506 -- CONSTRUCTION INDOOR AIR QUALITY

PART 1.00 -- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the work of this Section

B. Coordinate Construction IAQ Plan with independent the Maryland Stadium Authority

1.02 RELATED WORK

A. Section 011000 - Summary of Work
B. Section 013520 - Sustainable Design Requirements

1.03 SUMMARY

A. Section includes:

1. Submittal Requirements for this section.
2. The Maryland Stadium Authority's "Alteration & Addition Construction & Pre-Occupancy Indoor Air Quality (IAQ) Management Plan"

1.04 REFERENCES

A. Reference Standards: In addition to requirements shown or specified, comply with applicable provisions of the following:

1. SMACNA IQA Guidelines for Occupied Buildings Under Construction, First Edition 1995. Sheet Metal and Air Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Drive, Chantilly, VA 20151-1209.

2. USGBC LEED Reference Guide, current edition (Leadership in Energy and Environmental Design) Green Building Rating System. www.usgbc.org

3. Maryland Stadium Authority's "Alteration and Addition Construction and Pre-Occupancy Indoor Air Quality (IAQ) Management Plan"

1.05 DEFINITIONS

A. Volatile Organic Compounds (VOCs): are any carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate).

B. Type A Finishes: Material and finishes with potential for short-term levels of off-gassing from chemicals inherent in their manufacturing process, or which are applied in form requiring vehicles or carriers for spreading which release high levels of particulate matter in the process of installation and/or curing. Including, but not limited to:

1. Composite wood products, specifically including particleboard from which millwork, doors, or furniture may be fabricated.
2. Adhesives, sealants, and glazing compounds, specifically those with petrochemical vehicles or carriers.
3. Wood preservatives, finishes, and paint.
4. Control and/or expansion joint fillers.
5. Hard finishes requiring adhesive installation.
6. Gypsum board and associated finish processes.

C. Type B Finishes: Fuzzy material and finishes which are woven, fibrous, or porous innature and tend to absorb chemicals off-gassed by Type A finishes or may be adversely affected by particulates. These materials become "sinks" for deleterious substances which may be released much later, or collectors of contaminants that may promote subsequent bacterial growth. Including, but not limited to:

1. Carpet and padding.
2. Insulation exposed to air stream.
3. Acoustic ceiling materials.
4. Tectum acoustic wall panels.
5. Upholstered furnishings.
6. Materials that can be categorized as both Type A and Type B.

1.06 SUBMITTALS

A. General: Submit in accordance with Section 01300 Submittals.

B. Informational Submittals: Submit the following:

1. A materials log book is required that includes MSDS sheets and additional information on chemical content of selected materials, including Volatile Organic Compounds (VOC) in terms of grams per liter (g/L) highlighted showing compliance with specification requirements. This log book shall be maintained by the contractor throughout the life of the project, shall be updated monthly to include any newly approved products, shall be available at all times to the Owner's Representative, and shall be submitted at the conclusion of construction.
2. Provide photographs of protected materials, duct sealing and other measures taken at regular intervals throughout the period of construction.
3. Provide Cut Sheets of filtration media used during construction and installed immediately prior to occupancy highlighting MERV values.
4. Coordinate and incorporate all work described herein with construction schedules.
5. Passive Indoor Air Quality Test results.
6. Minutes or other evidence of meetings with each subcontractor explaining the IAQ plan between the General Contractor and each subcontractor.
7. Provide photographs and cut sheets of temporary barriers and other pathway interruption measures.
8. Provide photographs of fossil fuel burning equipment use (if applicable) outside and away from air intakes.
9. Provide documentation from the Building Automation System (BAS) of flush out activity.

1.07 QUALITY ASSURANCE

A. Indoor Air Quality Coordinator: Contractor shall designate a staff member as an IAQ coordinator to implement and monitor the MSA's Alteration and Addition Construction and

Pre-Occupancy Indoor Air Quality (IAQ) Management Plan

B. Regulatory Requirements: Comply with applicable codes, laws, rules, and regulations of authorities having jurisdiction concerning indoor air quality.

1.08 LOW-EMITTING MATERIALS

A. Adhesives, sealants, sealant primers shall meet or be within the VOC limits of the sustainable design requirements section.

B. Paints and coatings shall meet or be within the VOC and chemical component limits of the sustainable design requirement section.

D. Composite Wood-shall meet or be within the limits of the sustainable design requirements section.

1.09 PROJECT CONDITIONS

A. Environmental Requirements: Comply with requirements of other sections as appropriate.

B. Comply with additional requirements within the MSA’s IAQ Plan.

1.10 SEQUENCE AND SCHEDULING

A. General: Sequence and schedule work in accordance with other sections as appropriate.

B. Comply with additional requirements within the MSA’s IAQ Plan.

1.11 SYSTEM FLUSH OUT

A. General: Comply with the requirements for the MSA’s IAQ Plan to flush out the renovated area after construction and prior to occupancy of the Area of Work.

PART 2.00 -- PRODUCTS (Not Used)

PART 3.00 -- EXECUTION

3.01 INDOOR AIR QUALITY

A. Comply with the Maryland Stadium Authority's "Alteration and Addition Construction and Pre-Occupancy Indoor Air Quality (IAQ) Management Plan"

Maryland Stadium Authority

Alteration and Addition Construction & Pre-Occupancy Indoor Air Quality (IAQ) Management Plan

Scope: The Maryland Stadium Authority (MSA) will implement this IAQ Management Plan prior to any alteration or addition to the building and space occupancy as specified for EQ Credit 1.5 of USGBC's Green Building Operations and Maintenance 2009 edition. This IAQ plan will establish goals and procedures to be implemented by the MSA and will be followed by all job site personnel. The Owner's objective is to reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and ultimately the building occupants. The project is also pursuing LEED certification from the US Green Building Council (USGBC) and as such is required to establish this plan and document its progress through the renovated space's occupancy. The LEED credit that is being pursued with the section is EQc1.5. The General Contractor is responsible for meeting all requirements necessary for obtaining this credit.

IAQ Goals:

During construction the construction team will:

- Protect the permanent HVAC system from dust and odors by either keeping all openings sealed prior to operation; or then not activating it during construction or, if activated, implementing recommended control measures.
- Protect and absorptive/porous materials from fumes and odors.
- Minimize and possibility of mold growth inside the building.

IAQ Coordinator:

The General Contractor will designate a staff member as IAQ coordinator to implement and monitor this plan. This person will provide reference materials regarding LEED Credit EQc1.5 at the building for Owner and subcontractor use. The coordinator will enforce the no smoking policy inside and outside the building and document implantation of this plan with photos taken at a minimum of three times throughout the construction process in the interior of the building. These photos will show the plan being implemented (covered duct ends, swept areas, covered carpeting, wrapped drywall, etc…)

IAQ Strategies:

1. IAQ activities and issues will be discussed at each subcontractor coordination/safety meeting.

2. As each new subcontractor arrives at the building for the first time, the General Contractor will present him/her with a copy of the plan and discuss IAQ responsibilities of that particular subcontractor.

3. The GC will determine if permanent HVAC equipment will be operated during the renovation or if temporary heating and ventilation will be provided. Tentative delivery dates of the equipment should be established along with the dates of initial start-up.

4. The GC will coordinate activities necessary to meet SMACNA IAQ Guidelines for Occupied Buildings under Construction, 2nd edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).

5. The GC will coordinate delivery, on site storage and installation of materials with weather and site conditions to limit the possibility of mold growth. Wet materials will not be used and all installed materials will be adequately protected from moisture.

6. Absorptive/porous materials stored on site or installed will be protected from dust and odors by isolating them from contaminated areas or sequencing installation well after contamination could occur.

7. All ductwork will arrive on site protected and remain as such until immediately before installation. All exposed edges of fiberglass duct insulation will be sealed with mastic before installation of ductwork and all openings in ducts will remain sealed until immediately before start up of equipment.

SMACNA Guidelines:

This standard provides specific measures to protect the HVAC system and ensure acceptable indoor air quality during construction. These measures are organized in five categories: HVAC Protection, Source Control, Pathway Interruption, Housekeeping and Scheduling.

1. HVAC Protection –If the system is used during construction all grilles and openings must be fitted for temporary filters of a MERV (Minimum Efficiency Reporting Value) of at least 8. Ductwork must also be protected before installation to prevent dust contamination. All filtration media must be replaced immediately before occupancy with filters having a MERV rating of 13.

2. Source Control – The project is required to use building materials and products with limited VOC (Volatile Organic Compounds) content. Fossil fuel burning equipment should be limited to use on exterior of the building away from intake louvers.

3. Pathway Interruption – This measure provides ways to isolate areas where harmful dust and/or odors are being generated from other areas of the building. Temporary barriers such as dust curtains are effective for this use. Pressurizing appropriate areas can also limit flow of contaminants as well as using 100% outside air for ventilation. Location of pollutant

sources should be considered whether inside the building or on the exterior if near an intake louver.

4. Housekeeping – Increasing cleaning frequency of the jobsite helps to reduce collection of dust and potential for mold growth. HEPA vacuums should be used inside the building as well as wetting agents for dust control. All cleaning agents should be chosen and used with caution to avoid introducing additional harmful fumes unto the building.

5. Scheduling – Off hours work should be considered if any construction activity generates an unacceptable level of harmful dust or odor.

6. Flush-Out Procedure – A flush out of the renovated space will be performed after all construction work has been completed including punch list items and prior to occupancy of the space. If the space's central HVAC system is being used to perform the flush-out, remove any temporary filters and duct coverings installed per the measures listed above. Install MERV 13 filtration where needed prior to the flush-out. Outside air is used to dilute and remove off-gassed contaminants. The quantity of outside air that must be introduced to the project space for the flush out is 14,000 cubic feet of air per square foot of floor area. The rate of outside air should not cause the interior temperature to drop below 60°F and the relative humidity should not exceed 60%. The initial flush out phase is complete when 3,500 cubic feet of air per square foot has been replaced. Occupants my move in after this initial flush out has been performed. The flush-out phase is complete once all 14,000 cubic feet of air per square foot has been supplied, at that time the HVAC system can be switched to its normal mode of operation.

Adhesives, Sealants, Paints and Coatings Purchasing Protocols

1. ALL adhesives and sealants used in the interior of the building (defined as inside the weatherproofing system and applied on site) must comply with the following reference standards:

   Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District Rule #1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.

2. All Paints and coatings used in the interior of the building (defined as inside the weatherproofing system and applied on site) must comply with the following referenced standards:

   Architectural paints, coatings and primers – Do not exceed VOC content limits established in: Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.

Anti corrosive and Anti-rust paints applied to interior ferrous metal substrates – Do not exceed the VOC content limit of 250 g/l established in: Green Seal Standard GS-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.

Clear wood finishes, floor coatings, stains, shellacs applied to interior elements – Do not exceed the VOC content limits established in: the South coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect January 1, 2004.

END OF SECTION

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Division 01 Section "Substitution Procedures" for requests for substitutions.

2. Division 01 Section “Sustainable Design Requirements” for general sustainability submission requirements

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

1.3 PERFORMANCE REQUIREMENTS

A. This project must comply with the Maryland Stadium Authority’s Sustainable Purchasing Policy for Facility Alterations and Additions. Develop a Sustainable Purchasing Plan that results in end-of Project rates for sustainable purchases as defined in this section of at least 50 percent

by cost of total purchases required by the Work and at least 40 percent of furniture purchases required by the Work.

1.4 ACTION SUBMITTALS

A. Sustainable Purchasing Plan: Prepare and submit for Owner's approval an electronic copy of the project's Sustainable Purchasing Plan

B. Final Sustainable Purchasing Report: Within 30 days after the date of substantial completion, submit an electronic copy of the final Sustainable Purchasing Report that includes the calculated end-of Project Sustainable Purchases rate as a percentage of total purchases required by the work.

C. Documentation of Sustainable Purchases: Provide documentation as an attachment to the Final Sustainable Purchasing Report, organized per division, for all sustainable products purchased for the project.

1. Documentation of Sustainability
   a. Provide documentation that Adhesives and Sealants have VOC content less than the current VOC content limits of SCAQMD Rule #1168, or sealants used as fillers meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
   b. Provide documentation that paints and coatings have VOC emissions not exceeding the VOC and chemical component limits of Green Seal's Standard GS-11 requirements.
      1) Provide documentation that anti-corrosive and anti-rust painted applied to interior ferrous metal substrates meet the VOC limits established in Green Seal Standards GS-03, Section Edition, January 7, 1997
      2) Provide documentation that clear wood finishes, floor coatings, stains, and shellacs applied to interior elements meet the VOC limits established in SCAQMD Rule #1113, January 1, 2004
   c. Provide documentation that non-carpet finished flooring is FloorScore-certified and constitutes a minimum of 25% of the finished floor area.
   d. Provide documentation that composite panels and agrifiber products contain no added urea-formaldehyde resins.
   e. Provide documentation that furniture purchases meet one of the following requirements:
      1) Furniture contains at least 10 percent post-consumer or 20 percent post-industrial material
      2) Furniture contains at least 50 percent rapidly renewable material
      3) Furniture contains at least 50 percent Forest Stewardship Council (FSC) certified wood
      4) Furniture contains at least 50 percent materials harvested and processed or extracted and processed regionally.

D. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Owner's Action: If necessary, Owner will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Owner will notify Contractor of approval or rejection of proposed comparable product request within **10** days of receipt of request, or **seven** days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Owner does not issue a decision on use of a comparable product request within time allocated.

E. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
5. Refer to specification section 015060 “Construction Indoor Air Quality” for additional requirements and procedures.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Refer to specification section 015060 “Construction Indoor Air Quality” for additional requirements and procedures.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

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

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

1.8 SUSTAINABLE PURCHASING PLAN

A. General: Develop plan consisting of product identification organized by division and indicate quantities by cost.

B. Product Identification: Indicate product names, manufacturers, and other identifying information for each material required by the Work. Include estimated costs for each product.

C. Cost Analysis: Indicate total cost of all products required by the work and total cost of all products which comply with the Sustainable Purchasing Policy. Show achievement of sustainable purchasing rate required in the Sustainable Purchasing Policy and listed in paragraph 1.3 of this section.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Where products are accompanied by the term "as selected," Owner will make selection.

4. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

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

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 SUSTAINABLE PURCHASING PLAN IMPLEMENTATION

A. General: Implement sustainability purchasing plan as approved by Owner.

B. Sustainable Purchasing Coordiantor: Designate a Sustainable Purchasing Coordinator who will be responsible for implementing, monitoring, and reporting on the Sustainable Purchasing Plan.

C. Final Sustainable Purchasing Report: Within 30 days after the date of substantial completion, submit an electronic copy of the final Sustainable Purchasing Report that includes the calculated end-of Project Sustainable Purchases rate as a percentage of total purchases required by the work.

END OF SECTION 016000

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "Summary" for limits on use of Project site.
2. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

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

1.3 QUALITY ASSURANCE

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

1. Structural Elements: When cutting and patching structural elements, notify Owner of locations and details of cutting and await directions from Owner before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

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

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Owner for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems**,** and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Owner according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to existing benchmarks. If discrepancies are discovered, notify Owner promptly.

B. General: Lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Owner when deviations from required lines and levels exceed allowable tolerances.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

3.4 FIELD ENGINEERING

A. Reference Points: Locate permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

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

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surface cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Develop a waste management plant that results in end-of-Project rates for salvage/recycling of 70 percent by volume of total waste generated by the Work.

B. The waste sorting facility must provide a waste diversion percentage specific to the project's waste based on measurement of each component waste material, or use the 'average' diversion rate for the facility. This diversion rate must be regulated by the local or state authority and must exclude ADC. This system must be a closed system; shipping waste to another municipality to manage. Visual inspection is not an acceptable method of evaluation for purposes of documenting purposes of documenting percentage of commingled waste diverted from landfill.

1.4 INFORMATIONAL SUBMITTALS

A. Waste Wanagement Plan: Prepare and submit for Owner's approval an electronic copy of the project's Waste Management Plan.

B. Final Construction Waste Management Report: Within 15 business days after the last dumpster is pulled from the site, submit an electronic copy of the Final Construction Waste Management Report that includes the calculated end-of-Project diversion rate as a percentage of total waste generated by the Work.

C. Documentation of Recycling and Disposal Process – Provide final documentation as an attachment to the Final Construction Waste Management Report, per recycling process utilized on the project.
   1. Documentation of Commingled Recycling Process
      a. Provide a list of diverted materials and a list of licensed recycling and processing facilities that accepted the recyclable waste generated by the project.
      b. Provide a list of licensed landfill and incinerator facilities that accepted trash waste generated by the project.
      c. Provide detailed calculation confirming the project's diversion rate and the corresponding quantity of both diverted waste and trash waste. Documentation can be either a project specific diversion rate provided by the processing facility or the average annual recycling rate for the sorting facility established by the regulating local or state government authority.
   2. Documentation of Separated On-Site Recycling Process
      a. Provide a list of diverted materials and a list of licensed recycling and processing facilities that accepted the recyclable waste generated by the project.
      b. Provide a list of licensed landfill and incinerator facilities that accepted trash waste generated by the project.
      c. Provide receipts confirming acceptance by a recycling or landfill facility. 100% of receipts must be provided and they are required to clearly indicate the type of material accepted and the weight of material in tons.
      d. Provide detailed calculation confirming the project's diversion rate and the corresponding quantity of diverted waste and quantity of trash waste.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

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

1.6 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates. Exclude hazardous waste, land-clearing debris, and soil.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept.
   2. Disposed Materials: Indicate how and where materials will be disposed of.
   3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
   1. Distribute waste management plan to everyone concerned.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
4. Divisions 02 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 5 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner’s signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of **5** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 5 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner, that must be completed or corrected before certificate will be issued.

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

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Owner's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction

1. Organize list of spaces in sequential order,
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Owner will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Owner for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
o. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Individual Divisions & Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least **5** days before commencing demonstration and training. Owner will return copy with comments.

1. Correct or revise each manual to comply with Owner's comments. Submit copies of each corrected manual within **5** days of receipt of Owner's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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

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

    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

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

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

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

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

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

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

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of O and M manuals.

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Divisions 02 through 16 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.

c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders**,** record Specifications**,** and record Drawings where applicable.

B. Format: Submit record Product Data as paper copy.

2.4 MISCELLANEOUS RECORD SUBMITTALS

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

B. Format: Submit miscellaneous record submittals as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Owner’s reference during normal working hours.

END OF SECTION 017839

DIVISION 6 – WOOD AND PLASTIC

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.

B. The rough carpentry work required shall include all such temporary and permanent work required throughout the project to complete the entire intent of the work, regardless of whether or not each and every item is specifically called for. Refer to drawings to determine the major extent of the rough carpentry work required.

C. Section Includes:

1. Carpentry work not specified as part of other sections and which generally is not exposed, except as otherwise indicated.
2. Rough carpentry for:
   a. Wood blocking.
   b. Miscellaneous lumber for, blocking, attachment and support of other work.
   c. Construction panels/concealed plywood for miscellaneous uses.
3. Fire retardant treatment.

1.2 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
1. Preservative treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and conformance with applicable standards.
2. For preservative treatment for aboveground use include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
3. Fire-retardant treatment: Include certification by treating plant that treatment material complies with specified standard and other requirements.

1.3 REFERENCES

A. AWPA C20-88 -- Structural Lumber--Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 1988.

B. AWPA C27-88 -- Plywood--Fire-Retardant Treatment by Pressure Processes; American

Wood-Preservers' Association; 1988.

C. AWPA M4-84 -- Standard for the Care of Preservative-Treated Wood Products; American Wood-Preservers' Association; 1984.

D. AWPB LP-2-88 -- American Wood Preservers Bureau Quality Control and Inspection Procedures for Softwood Lumber, Timber and Plywood Pressure Treated with Waterborne Preservatives for Above Ground Use; 1988.

E. NBS PS 20-70(86) -- American Softwood Lumber Standard; U.S. Department of Commerce, National Bureau of Standards; 1970 (Amended 1986).

F. NFPA WCD #1 -- Manual for Wood Frame Construction; National Forest Products Association (NFPA); 1988.

1.4 QUALITY ASSURANCE

A. Lumber Standards: Manufacture lumber to comply with PS 20 and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Grade Stamps: Factory-mark each piece of lumber with trade stamp of inspection agency, evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

C. Construction Panel Standards: Comply with PS 1 for plywood panels; for products not manufactured under PS 1 provisions, comply with American Plywood Association (APA) Performance Standard PRP-108.

1.5 PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar material.

1.6 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
   1. Surfacing: Provide dressed lumber (S4S) with moisture content S-dry or MC19 (19 percent maximum moisture content).
   2. Partition Associated Blocking: Provide fire retardant treated 2x wood blocking as

required as backing for partition mounted items including, but not limited to, wall cabinets, marker & tack boards & strips, projection screen brackets, wall-mounted door stops, adjustable shelving brackets, wall-mounted still, etc.

B. Miscellaneous Lumber: Provide wood for support or attachment of other work. Provide lumber of sizes indicated, worked into shapes shown.
   1. Moisture content: 19 percent maximum (S-dry).
   2. Lumber: S4S, No. 2 or standard grade.
   3. Boards: Construction, 2 common, or No. 2 grade.

2.2 CONSTRUCTION PANELS/CONCEALED PLYWOOD

A. Construction Panels/Plywood: Miscellaneous uses.
   1. Concealed plywood: C-C Plugged exterior, fire-retardant treated.
   2. Electrical/telephone panel backer: APA rated sheathing, Exposure I, Treating Grade fire-retardant treated.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, materials and finish as indicated and as recommended by applicable standards.
   1. Comply with applicable Federal Specifications for nails, staples, screws, and framing anchors of the size and type recommended by the manufacturer for each use.
   2. Provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153) for treated lumber and where rough carpentry work is either in ground contact, in an area of high relative humidity, or exposed to weather.

B. Unless otherwise called out, wood blocking, curbing, nailers, etc., of 2" nominal thickness or greater shall be bolted to back-up material.

C. Unless otherwise called out, wood nailers, furring etc., less than 2" nominal thickness shall be secured to back-up material by use of appropriate fasteners located 4" from ends and spaced not greater than 16" o.c. along lengths of the members. Type and length of fastening devices shall be such as to develop sufficient anchorage to the back-up material.

D. Where nailing or power-driving into concrete or masonry is done, take care to avoid puncturing conduits, pipes, ducts, etc., embedded in such work.

2.4 WOOD TREATMENT BY PRESSURE PROCESS

A. Fire-Retardant Treatment:
   1. Where fire-retardant treated wood (FRTW) is indicated, pressure-impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27 respectively.
   2. Identify FRTW with appropriate classification markings of Underwriters Laboratories, Inc., Timber Products Inspection, or other testing agency acceptable to authorities having jurisdiction.
   3. Treat the following items:
      a. Backer panels for electrical and telephone equipment.
      b. All permanent blocking, studs, plywood, etc. that will be concealed in the finished work.

c. Other as shown on drawings.
4. Provide one of the following:
a. "Pyro-Guard"; Hoover Treated Wood Products, Inc.
b. "Dricon"' Hickson Corporation.

C. Inspect each piece of treated wood before use and discard all defective pieces.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Discard units of material with defects which might impair of work and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3.2 MISCELLANEOUS CARPENTRY

A. Provide misc. blocking, nailers, grounds, and framing as shown and as required for support of facing materials, fixtures, specialty items, and trim. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Provide a minimum of 1/4" spacing at butt end joints for all continuous materials.

3.3 WOOD FRAMING - GENERAL

A. Provide framing members of sizes and on spacings shown, frame openings as shown, or, if not shown, comply with recommendations of NFPA Manual for Wood Frame Construction. Do not splice structural members between supports.

B. Anchor and nail as shown and to comply with "Recommended Nailing Schedule" of NFPA Manual for Wood Frame Construction and NFPA Design Specification.
1. Miscellaneous plywood panels: Nail or screw to supports.

END OF SECTION 061000

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 072000 - THERMAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.

B. Section Includes:
1. Sound attenuation insulation (mineral fiber).
   a. All new interior partitions shall have sound attenuation insulation.
2. Safing insulation (mineral fiber).
   a. All corridor partitions shall be resistant to the passage of smoke and have the void between the wall and the deck above stuffed tight with safing insulation.

1.2 REFERENCES

A. 40 CFR 763, Appendix A to Subpart F - Interim Method of the Determination of Asbestos in Bulk Insulation Samples; Code of Federal Regulations; Office of the Federal Register, National Archives and Records Administration; 1986.

B. ASTM E 84-89 - Standard Test Method for Surface Burning Characteristics of Building Materials; 1989.

C. ASTM E 119-88 - Standard Test Methods for Fire Tests of Building Construction and Materials; 1988.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Product Data: Submit manufacturer’s product literature and installation instructions.

1.4 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide materials tested using methods indicated below, by Underwriters Laboratories Inc. or other testing agency acceptable to authorities having jurisdiction.
1. Surface burning characteristics: ASTM E 84.
2. Fire resistance ratings: ASTM E 119.
3. Combustion characteristics: ASTM E 136.

B. Maximum Allowable Asbestos Content: Provide insulation materials which do not contain any type or mixture of types of asbestos.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Comply with manufacturer's recommendations for handling, storage, and protection during installation. Protect insulation materials from physical damage and from becoming wet.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide insulation in preformed units from manufacturer's standard thicknesses, widths, and lengths, and sized as indicated.

B. Mineral (Rock or Slag) Fiber Insulation: Blanket/Batt for use in interior partitions indicated to have Sound Attenuation Blanket: Provide insulation manufactured by combining semi-refractory mineral fibers derived from slag with thermosetting resin binders, and as follows:
   1. Comply with the following:
      a. ASTM C 665 requirement for classification.
      b. ASTM E 136 combustion test requirements.
         1) Maximum flame spread - 25.
         2) Maximum smoke developed - 50.
   2. Provide unfaced blanket/batt; Type 1.
   3. Thickness: 3 ½" in partitions indicated to be sound insulated.
   4. Manufacturers of Mineral (Rock or Slab) Fiber Insulation: Provide products complying with requirements of the Contract Documents and made by one of the following:
      a. Roxul AFB (Acoustical Fire Batt Insulation).
      b. Approved equivalent product.
   5. **Fiberglass sound insulation is not acceptable**.

C. Safing Insulation: Blanket/batt for use in interior voids where sealing is required to maintain the fire rating of a partition. Provide insulation manufactured by combining semi-refractory mineral fibers derived from slag with thermosetting resin binders, and as follows:
   1. Comply with the following:
      a. ASTM C 665 requirement for classification.
      b. ASTM E 136 combustion test requirements.
         1) Maximum flame spread - 25.
         2) Maximum smoke developed - 50.
   2. Provide un-faced blanket/batt: Type I.
   3. Thickness: 3 ½" minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify satisfactory condition of substrates and adjacent materials. They shall be clean, dry, and ready to receive insulation.

2. Verify that mechanical and electrical work within walls where insulation is to be applied has been completed before beginning the installation.
3. Verify that masonry materials have dried sufficiently and attained optimum moisture content.
4. Verify that insulation materials to be installed are free of damage.

3.2 PREPARATION

A. Remove projections and clean substrates of any substances which might damage materials to be installed.

3.3 INSTALLATION

A. General:
1. Install insulation in accordance with manufacturer's recommended procedures. Consult manufacturer's representative for specific recommendations if printed instructions are not provided or do not apply to project conditions.
2. Install units with adhesive and/or mechanical anchorage as indicated, or if not indicated, as recommended by insulation manufacturer to provide permanent placement and support of insulation.
a. Friction-fit unflanged blanket/batt insulation between framing members in accordance with manufacturer's recommended procedures.
3. Completely fill intended spaces. Leave no gaps or voids.
4. Cut insulation neatly as required to fit tightly around obstructions.

3.4 PROTECTION

A. Finish concealing work promptly upon completion of insulation work wherever possible, to protect insulation materials from exposure to weather or physical abuse. Where this is not possible, erect temporary coverings or enclosures to prevent damage.

END OF SECTION 072000

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 079000 -- JOINT SEALERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. The following interior joints:
   a. Wall-to-adjacent-surface joints (including wall/wall, wall/column and wall/ceiling joints).
   b. Joints around perimeter of frames.
   c. Joint between floor and plumbing fixtures.

B. Joints of similar nature to those indicated on the schedule shall be sealed with same sealer, whether or not indicated above or on drawings to be sealed or not.

1.2 RELATED SECTIONS

A. Section 08800 – Glazing Sealants.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical data for each joint sealer required, including instructions for joint preparation and joint sealer application.

B. Samples for Color Selection: Manufacturer's standard bead samples consisting of actual strips showing full range of colors available.

C. Special Warranty: Warrant for three years from Date of Substantial Completion, that sealants and accessories which fail to achieve airtight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure, will be replaced. Warranty shall cover labor and materials and shall not be pro-rated.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Completion of similar applications within 5 years prior to installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels showing manufacturer, product name, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Joint Dimension Conditions: Do not proceed with installation of sealers when joint dimensions are not within limits recommended by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.1 MATERIALS – GENERAL

A. General: Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put, and which comply with all requirements of the contract documents.
   1. Single source responsibility: Obtain sealer materials from a single manufacturer for each generic product required.
   2. Compatibility: Provide sealers, fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application.
   3. Colors of exposed sealers: as selected by the architect from manufacturer's full range of colors including custom colors if required.

2.2 INTERIOR JOINT SEALANTS

A. Siliconized Acrylic Latex Sealant: Paintable, one-part, movement capability plus or minus 25%. ASTM C834, Type OP, Grade NF Class 25. **For use in interior control joints in painted masonry and gypsum board.**

B. Sanitary Silicone Sealant: One-part, movement capability plus or minus 25%, fungus resistant, ASTM C920, Type S, Grade NS Class 25, FDA approved. **For use around plumbing fixtures and surrounding surfaces.**

2.3 JOINT FILLERS AND BACKING

A. Plastic Foam Joint Filler: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material indicated below, and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated.

B. Cleaner for Nonporous Surfaces: Provide nonstaining chemical cleaner or type acceptable to manufacturer of sealer and backing materials.

C. Masking Tape: Provide nonstaining, nonabsorbent type.

PART 3 - EXECUTION

3.1 INSPECTION

A. Require installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers in accordance with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer.

B. Joint Priming: Prime joint substrates where recommended by joint sealer manufacturer based on prior experience. Apply primer to comply with joint sealer manufacturer's recommendations.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Installation of Sealant Backings:
   1. Install joint filler to provide support of sealant during application and at position required to produce the cross-sectional shape and depth of installed sealant relative to joint width which allows optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
      b. Back all exterior joints with joint backing material to prevent back bond.
      c. Do not stretch, twist, puncture, or tear joint fillers.

C. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

D. Apply sealants before field painting of adjacent surfaces and without smearing on adjacent surfaces.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or are not approved by sealant manufacturer. Do not use fingers to tool joints.

3.4 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work and without additional cost to the owner.

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

END OF SECTION 079000

DIVISION 8 – DOORS AND WINDOWS

SECTION 081113 -- STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.

B. Section Includes:
1. Steel doors and frames.
2. Door accessories - anchors, clips, etc.

C. Related Sections:
1. Building in anchors and grouting frames in gypsum & metal stud construction: Section 092216.
2. Finish hardware: Section 087100.
3. Painting: Section 099000.

1.2 REFERENCES

A. ANSI A115 Series -- Door and Frame Preparation; 1978-82.

B. ANSI/SDI 100-1991--Recommended Specifications: Standard Steel Doors and Frames; Steel Door Institute; 1991.

C. ASTM A 153-82 (87) -- Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 1982 (Reapproved 1987).

D. ASTM A 366/A 366M-85 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1985.

E. ASTM A 525-87 -- Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 1987.

F. ASTM A 526/A 526M-85 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality; 1985.

G. ASTM A 568-88a -- Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for; 1988.

H. ASTM A 569/A 569/M-85 -- Standard Specification for Steel, Carbon (0.15, Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; 1985.

I. ASTM A 591/A 591M-89 -- Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications; 1989.

J. ASTM C 236-87 -- Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box; 1987.

K. ASTM E 152-81a -- Standard Methods of Fire Tests of Door Assemblies; 1981.

L. NFPA 80 -- Standard for Fire Doors and Windows; National Fire Protection Ass'n; 1986.

M. SDI 105-87 -- Recommended Erection Instructions for Steel Frames; Steel Door Inst.; 1987.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's technical data substantiating that products comply with requirements.

C. Shop Drawings: Submit for fabrication and installation of steel doors and frames, including the following:
1. Details of construction, joints, finish, and connections.
2. Details of each frame type, including anchorage.
3. Elevations of door design types.
4. Conditions at openings, including coordination w/glass and glazing requirement
5. Location and installation requirements of finish hardware and reinforcements.
6. Schedule, using same reference numbers for details and openings as those in contract documents.

1.4 QUALITY ASSURANCE

A. Provide products that comply with ANSI/SDI 100 and other requirements specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products of this section in cartons or crated to provide protection during transit and job storage.

B. Inspect products upon delivery for damage. Minor damage may be repaired provided refinished items are equal in all respects to new work and acceptable to the architect; otherwise, remove and replace damaged items as directed.

C. Store products at building site under cover. Place on minimum 4-inch-high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper becomes wet, remove carton immediately.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled, oiled, and complying with ASTM A 569 and ASTM A 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel complying with ASTM A 366 and ASTM A 568, exposed, matte finish, oiled.

C. Galvanized Steel Sheets: Electrolytic zinc-coated steel sheets complying with ASTM A 591, Class A, mill phosphatized.

D. Supports and Anchors: Fabricated of not less than 18 gage galvanized sheet steel.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units.
1. Hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop Applied Paint:
1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.2 FABRICATION

A. Fabricate steel units to be rigid, neat in appearance, and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment in order to assure proper assembly at project site.

B. Fabricate exposed faces of doors from only cold-rolled steel.

C. Fabricate frames from either cold-rolled or hot-rolled steel (at fabricator's option).

D. Fabricate concealed stiffeners, reinforcement, and edge channels from either cold-rolled or hot-rolled steel (at fabricator's option).

E. Close top and bottom edges of doors as integral part of door construction or by addition of minimum 14 gage inverted steel channels.

F. Provide countersunk, flat Phillips-head screws and bolts for locations requiring exposed fasteners.

G. Finish Hardware Preparation: Prepare doors and frames to receive finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.

H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

I. Locate finish hardware as indicated on final shop drawings.

J. Shop Painting:
1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint .

2.3 STEEL DOORS

A. General: Provide flush steel doors fabricated and reinforced per requirements of ANSI/SDI 100 (most recent edition).

B. Interior Doors (16 ga.):
1. Grade and model: Grade II, Heavy-duty, Model 2 (Seamless - Hollow Steel Construction).
2. Finish: All doors shall be bonderized and finished with one coat of baked-on prime coat of paint.

2.4 STEEL FRAMES

A. General: Provide steel frames for openings indicated, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.
1. Interior Frames: Fabricate interior frames of configuration and depth indicated. Minimum thickness as follows;
a. Level 2 Heavy duty: for use with Door Model 2 (seamless design) 0.059 inch minimum steel frame thickness (16 ga.).

2. Fabricate all frames with mitered and welded corners ground smooth and flush on exposed surfaces. Frames shall be factory welded.

B. Provide units of galvanized steel in the following locations:
1. N/A

C. After fabrication of frames, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth. Frames shall then have surfaces degreased and thoroughly cleaned of rust, oil and blemishes. Exposed surfaces for painted frames shall be phosphate-coated, and a knife grade mineral paste filler shall be applied to fill any remaining surface irregularities. Painted frames shall be sprayed on all surfaces of the frame with rust inhibiting prime paint either air-dried or baked-on. The finish shall meet the requirements for acceptance stated in ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces".

D. Door Silencers: Drill stops to receive silencers.
1. Provide 3 silencers on strike jambs of single-swing frames.
2. Provide 2 silencers on heads of frames for pairs of doors.

E. Plaster Guards: Provide 26 gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior openings.

F. Wall Anchors: Provide concealed metal wall anchors of sizes, shapes, and designs appropriate for adjoining wall construction. Wall anchors shall be non-removable, welded-on, and of same material and gauge as the frame. Frames 7'-6" in height and less shall be provided with three anchors per jamb at masonry and concrete walls and four anchors per jamb at other types of walls and partitions. One additional anchor shall be added per jamb for each additional 30" in height, or part thereof.
1. At masonry, wall anchors shall be adjustable strap anchors, 10" minimum length, crimped or perforated, in accordance with manufacturer's standards.
2. At steel stud construction, wall anchors shall be welded on "Zee" type for sheet metal screw attachment to the steel studs, as called for on the drawings and as recommended by frame manufacturer.
3. At construction other than specified above, if any, wall anchors shall be as called for on the drawings and, in lieu of such indication, as recommended by frame manufacturer for each of the required conditions, subject to approval of the Architect.
4. Notwithstanding the above specific requirements, at U.L. labeled frames, wall

anchors in each case shall conform to the requirements of Underwriters' Laboratories, Inc.

G. Floor Anchors: Floor anchors shall be securely welded inside each jamb with two holes for floor anchorage. Minimum gage to be 16 gage.

H. Prepare all frames for all mortise template hardware and reinforced only for surface mounted hardware. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8.

I. Manufacturers: Products of the following manufacturers, provided they comply with the requirements of the Contract Documents, will be acceptable:
1. Fenestra Corporation.
2. Ceco Corporation.
3. Pioneer Builders.
4. Steelcraft/Division of American Standard Co.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with manufacturer's data and as specified herein.

B. Frame Installation:
1. General: Comply with provisions of SDI 105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.
2. Place frames prior to construction of enclosing walls, ceilings or soffits. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
3. Anchors: Provide at least 3 wall anchors per jamb at hinge and strike levels and minimum 18 gage base anchors.
4. In closed steel stud partitions, attach anchors to studs w/tapping screws.

C. Door Installation:
1. Fit steel doors accurately in frames, within clearances specified in ANSI/SDI 100.

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after erection, sand smooth damaged areas of prime coat and apply touch-up coat of compatible air-drying primer.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel items undamaged and in complete and proper operating condition.

END OF SECTION 081113

DIVISION 8 – DOORS & WINDOWS

SECTION 087100 -- DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.

B. Section Includes:
1. All door hardware indicated in the Hardware Schedules at the end of this section.
2. Other items of hardware and miscellaneous accessories to complete the installation in accordance with applicable codes shall be provided whether indicated in hardware schedule or not.

C. Keying:
1. Provide locksets without cylinders, which will be provided by the owner.

D. Related Sections:
1. Silencers for hollow metal frames: Elsewhere in Division 8.

1.2 REFERENCES

A. ANSI A156.7-1981 -- American National Standard for Template Hinge Dimensions; 1981.

B. ANSI A156.16-1981 -- American National Standard for Auxiliary Hardware; 1981.

C. ANSI/BHMA A156.6-1986 -- American National Standard for Architectural Door Trim; 1986.

D. ANSI/BHMA A156.14-1985 -- American National Standard for Sliding and Folding Door Hardware; 1985.

E. ANSI/BHMA A156.18-1987 -- American National Standard for Materials and Finishes; 1987.

F. Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames; Door and Hardware Institute (DHI); 1975.

G. NFPA 80 -- Standard for Fire Doors and Windows; National Fire Protection Association; 1986.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Make submittals in the order required for job expedition, unless submitted simultaneously. Acceptance of hardware schedule must precede fabrication of other work (e.g. hollow metal schedule) which is critical in the project construction schedule.

C. Supplier Qualifications: To the architect for information.

D. Product Data: Manufacturer's technical data for each item with installation instructions.

E. Hardware Schedule: Indicate complete designations of every item for each door. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function and finish of hardware.
   1. **Clear cross-reference to Architect's designations in contract documents**.
   2. Indicate door and frame sizes and materials.
   3. Explain all abbreviations, symbols, codes, etc.
   4. Indicate hardware mounting locations.
   5. Include the following information for each item:
      a. Type, style, function, size and finish.
      b. Name and manufacturer.
      c. Fastenings.
      d. Other pertinent information including compliance of fire door hardware with applicable standards.
   6. Preliminary schedule will be reviewed if accompanied by product data

F. Operation and Maintenance Data: For operating parts and finishes.

1.4 QUALITY ASSURANCE

A. The General Contractor shall coordinate all aspects of Hollow Metal Work, Wood Doors, Accessories, etc. with hardware requirements.

B. Qualifications of Supplier: A recognized supplier of architectural finish hardware, with warehousing facilities, who has been furnishing hardware in the vicinity of the project for not less than 5 years and who is or who employs an Architectural Hardware Consultant.

C. Qualifications of Architectural Hardware Consultant(s): Certified by the Door and Hardware Institute.

1.5 PROJECT CONDITIONS

A. Sequence submittal of hardware schedule and door and frame submittals allowing adequate time for review and resubmittal, if required, so that construction is not delayed; provide adequate information for review.

B. Furnish hardware templates to each fabricator of other work which is to be factory-prepared for the installation of hardware.

C. Coordinate shop drawings of such other work to confirm that adequate provisions are made for installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware at the times and to the locations required for timely installation.

B. Tag each item separately with identification related to hardware set number and door number.

PART 2 - PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

A. Required Finish Hardware: Contractor shall furnish all finish hardware required for the project.

Hardware not specified for a particular opening shall be furnished under this Section and shall conform to hardware for similar openings elsewhere in the building. The manufacturers specified are required for the products given.

B. In addition to requirements of the hardware groups attached, comply with the following requirements.

C. Select style and features of each item to suit configuration and construction of door and frame and door operation indicated.

D. Coordinate hardware requirements with electrical requirements in Division 16.

E. Provide rubber silencers for hollow metal frames, three for single doors and two for double doors.

2.2 MATERIALS - GENERAL

A. Manufacturers:
1. Obtain all items of each type from the same manufacturer.

B. Provide hardware manufactured to conform to published templates.

C. Fasteners: Provide all fasteners required for secure installation.
1. Select fasteners appropriate to substrate and material being fastened.
2. Use machine screws unless otherwise indicated.
3. Use Phillips flathead screws unless otherwise indicated.
4. Use wood screws for installation in wood.
5. Exposed screws: Match hardware finish.
6. Do not use through-bolts where bolt head or nut on opposite face would be exposed in finished work, unless otherwise indicated.
   a. Where bolt head or nut is exposed in finished work, provide the same finish as hardware on that side of the door.
   b. Provide sleeves for through-bolts or use sex screw fasteners.
   c. Use through-bolts where it is not possible to reinforce substrate adequately (on all mineral core wood fire-rated doors) and at all door closers, hold-opens and exit devices.

D. Finish on all exposed metal items, unless noted otherwise:
1. Butts - satin chrome - US 26D or satin finish stainless steel - US 32D.
2. Locks and latches - satin chrome - US 26D.
3. Flush Bolts – satin finish stainless steel – US 32D.
4. Closers – satin finish stainless steel covers.
5. Armor and mop plates - .050” satin finish stainless steel.

2.3 HINGES

A. Manufacturers:
1. Butt hinges: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be considered acceptable:
   a. Hager Hinge Company.
   b. McKinney Products Company.
   c. Stanley Hardware Division/The Stanley Works.

B. Butt Hinges:

1. Interior hinges shall be standard weight (.134 or .146 ga.), five-knuckle, two ball bearing for standard stainless steel, full mortise type with stainless steel, non-removable pin.
2. Dimensions: As indicated, within limits prescribed by ANSI A 156.7.
   a. Size(s): 4-1/2" x 4-1/2", minimum. Doors 3'-2" and wider shall receive 5" x 4-1/2" hinges.
3. Quantity: Provide minimum of 3 hinges on each door; add one hinge for each 30" height above 90" door height.

2.4 LOCKS, LATCHES AND BOLTS

A. Manufacturers:
   1. Locks and latches shall be Corbin Russwin ML2000 and match the existing installation manufacturer. Locksets and latchsets shall be mortise-type and shall be provided less (without) cylinders. All locksets and latchsets shall be ADA compliant lever operated. Lever style Lustra (LWF).

B. Mortise Locksets/Latchsets: ANSI 156.1and A117.1 Accessibility Code for lever design, Series 2000, Grade 1 w/wrought steel case, 8" x 1-1/4" armor front, 3/4" throw, two-piece stainless steel anti-friction reversible latch bolt. Stainless stl., 1" throw deadbolt.
   1. Trim: Provide lever and rose type, thru-bolted, heavy cold forged stainless steel. ADA compliant levers shall be provided on all locks and latchsets, cold forged and reinforced stainless steel.

C. Strikes: Provide strike for each latch bolt and lock bolt.
   1. Finish to match other hardware on door.
   2. Use wrought box strikes with curved lips unless otherwise indicated.
   3. In floors, use dust-proof strikes.

2.5 LOCK CYLINDERS AND KEYING

A. Cylinders and Keying: Cylinders will be provided by the owner. Coordinate with owner for installation of cylinders into contractor-provided locksets.

2.6 DOOR CONTROL DEVICES

A. Manufacturers:
   1. Closers: Products of the following manufacturers, provided they comply with requirements of the contract documents and ADA opening force requirements for both exterior and interior doors, will be considered acceptable:
      a. Dorma 8600 Series

   2. Wall-and-floor-mounted and overhead stops and holders: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be considered acceptable.
      a. Glynn-Johnson Division/Ingersol-Rand.
      b. H.B. Ives, A Harrow Company.
      c. Quality Hardware Manufacturing Company.

B. Closers - General:
   1. Closers shall be delayed action, barrier-free, full rack and pinion, conforming to ANSI A156.4, Grade 1. Features include drop plate where required, stop and hold-open at 75 degrees to 180 degrees, adjustable latching and closing speeds. Provide closers one size larger than that

recommended for use with standard arms. Body shall be optional metal. Finish shall be from manufacturer's full range to match existing closers to remain.

2. Except as otherwise specifically indicated, comply with manufacturer's recommendations for size of closer, depending on size and weight of door, exposure to weather and anticipated frequency of use.
3. Size closer or adjust closer opening force to comply with applicable codes including ADA. Closers should comply with UL-10C and UBC 7-2 Positive Pressure Fire Test
4. All closers shall be suitable for standard, corner bracket, top jamb, parallel and track type applications when provided with proper brackets and arms.
5. Projection of closer body from door shall not exceed 2 3/16".
6. All closers shall be through-bolted on wood and metal doors.
7. Provide limited 25-year warranty on closer unit.
8. Closers are to mount on room-entered side of opening.

C. Stops:
1. Wall-mounted: "Style 407 1/2", stainless steel by Ives.
   a. Comply with requirements of ANSI A156.16.
2. Floor-mounted: "Style 436 Dome Stop," aluminum by Ives.
   a. Comply with requirements of ANSI A156.16.
   b. Provide floor-mounted when no wall is adjacent to door @ 90 deg.
3. Provide gray resilient parts for exposed bumpers.
4. Where brand-name products are listed, products of other manufacturers, provided they comply with requirements of the contract documents, will be considered for substitution.

D. Overhead Stops:
1. Surface Mounted: Similar to Sargent "590 Series" surface application.
2. Arm and bracket attach to top jamb.
3. All overhead stops shall be through-bolted on wood and metal doors

2.7 ARCHITECTURAL DOOR TRIM

A. Manufacturers:
1. Architectural door trim: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable.
   a. H. B. Ives, A Harrow Company.
   b. Quality Hardware Manufacturing Company.
   c. Brookline.

B. Protection Plates: Stainless steel, 0.050 inch thick (U.S. 18 gage), satin finish (630).
1. Comply with requirements of ANSI/BHMA A156.6.
2. Mop-plates: 8 inches high by 2 inches less than door width.
3. Bevel all three sides.
4. Fasten with countersunk flathead screws.

2.8 ELECTRIC HARDWARE

A. Electric Hinges:

1. Products from the following manufacturers, provided they comply with the requirements of the contract documents, will be considered acceptable:

a. Hager Hinge Company
b. McKinney Products Company
c. Stanley Hardware Division / The Stanley Works

2. Provide electric hinges in gauges and sizes per butt hinge requirements and containing wiring necessary for connected electrified hardware.

B. Electric Power Supply:
1. For Electric Locksets: BPS Series Power Supply, provide quantity and capacity as recommended by manufacturer for installation conditions.

C. Electric Locks and Latches: Corbin Russwin ML20900 ECL Electrified, Grade 1 w/wrought steel case, 8" x 1-1/4" armor front, 3/4" throw, two-piece stainless steel anti-friction reversible latch bolt. Stainless stl., 1" throw deadbolt. Lever style Lustra (LWF).

PART 3 - EXECUTION

3.1 PREPARATION

A. Factory or shop-prepare all work for installation of hardware.

3.2 INSTALLATION

A. Follow hardware manufacturer's instructions and recommendations.

B. Install surface-mounted items after substrates have been completely finished; install recessed items and recessed portions of items before finishes are applied and provide suitable, effective protection.
1. When surface-mounted items are installed before final finish, remove, store and reinstall or supply suitable effective protection.

C. Mount at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
1. Exception(s):
a. As required to comply with applicable regulations.

D. Set units level, plumb and true to line and location.

E. Reinforce substrates as necessary for proper installation and operation.

F. Set thresholds in full bed of sealant.

3.3 ADJUSTMENT

A. Adjust each operating item of hardware and each door for proper operation and function; replace units which cannot be adjusted to operate freely and smoothly.

B. Adjust door closers to compensate for operation of heating and ventilating systems.

C. Wherever hardware installation is made more than one month prior to completion or occupancy of a space or area, readjust all hardware items in that area not more than one week prior to such completion or occupancy, restore to proper operation.

D. Readjust all hardware as required by paragraph 1.07B of this specification section.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Instruct the owner's personnel in operation and maintenance of hardware and finishes.

3.5 CLEANING

A. Clean adjacent surfaces soiled by hardware installation.

3.7 INSPECTION AND ADJUSTMENT

A. Six months following Substantial Completion the Supplier shall visit the jobsite and inspect the complete installation and adjust all hardware to work properly, replacing any defective items. Advise Architect in advance of inspection & provide written summary.

3.8 HARDWARE SETS

H-1
5 heavy-duty hinges
1 electric hinge
1 electrified lockset w/ lever set (live leaf)
1 set manual flush bolts (dead leaf w/ no exterior trim)
1 astragal (live leaf)
1 overhead closer
2 wall stops
2 kick plates (corridor side)
1 power supply

H-2
3 heavy-duty hinges
1 lockset (storage)
1 overhead stop
1 kick plate (reception side)

H-3
3 heavy-duty hinges
1 locket (office)
1 wall stop

H-4
3 heavy-duty hinges
1 lockset (privacy w/ occupancy indicator)
1 closer
1 wall stop
1 kick plate (corridor side)

H-5
5 heavy-duty hinges
1 electric hinge
1 electrified lockset w/ lever set (live leaf)
1 set manual flush bolts (dead leaf w/ no exterior trim)
1 astragal (live leaf)
1 overhead closer
2 overhead stops
4 kick plates
1 power supply

END OF SECTION 087100

DIVISION 9 – FINISHES

SECTION 092216 - GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder..

1.2 SUMMARY

A. Section Includes:
   1. Metal support systems.
      a. Gypsum wallboard walls and ceilings.
   2. Gypsum wallboard
      a. Screw-attached to steel framing and furring members.
   3. Drywall finishing.

1.3 REFERENCES

A. ASTM A 641-82 -- Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 1982.

B. ASTM C 36-85(88) -- Standard Specification for Gypsum Wallboard; 1985 (Reapproved 1988).

C. ASTM C 475-88 -- Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 1988.

D. ASTM C 645-88 -- Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board; 1988.

E. ASTM C 754-88 -- Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum; 1988.

F. ASTM C 840-88 -- Standard Specification for Application and Finishing of Gypsum Board; 1988.

G. ASTM C 1002-89 -- Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases; 1989.

H. ASTM E 119-88 -- Standard Test Methods for Fire Tests of Building Construction and Materials; 1988.

I. Fire Resistance Directory; Underwriters Laboratories Inc.; 1989.

J. GA-216-89 -- Recommended Specifications for the Application and Finishing of Gypsum Board; Gypsum Association; 1989.

K. GA-600-88 -- Fire Resistance Design Manual; Gypsum Association; 1988.

L. Gypsum Construction Handbook; United States Gypsum Co. (USG); 1992.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Product Data: Submit manufacturer's product data for systems required, including installation instructions and data sufficient to show compliance with requirements.
   2. Shop Drawings: Submit shop drawings for special assemblies designated on the drawings, including details sufficient to show compliance with design intent and performance requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Provide installation by a company specializing in work similar to that required on this project and with not less than 5 years of documented experience.

B. Regulatory Requirements: At locations indicated on drawings, provide fire-rated materials and assemblies tested per ASTM E 119 and acceptable to authorities for ratings required. Provide assemblies as listed in the following:
   1. GA-600, "Fire Resistance Design Manual."
   2. Underwriters Laboratories' (UL) "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original and unopened packages, containers, or bundles, with brand names and manufacturer's labels intact and legible.

B. Store materials in dry location, fully protected from weather and direct exposure to sunlight.

C. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges.

D. Store corner bead and other metal accessories to prevent distortion or damage.

1.7 PROJECT CONDITIONS

A. Temperature: Maintain temperature in areas of installation at not less than 55 degrees F for at least 24 hours before installation begins and for not less than 48 hours after joint finishing has been completed.

B. Ventilation: Provide controlled ventilation during joint finishing operations, to eliminate excessive moisture. Avoid drafts during hot, dry weather to prevent excessively fast drying of joint compound.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Steel framing and furring:
      a. Dale Industries, Inc.
      b. Dietrich Industries, Inc.
      c. Gold Bond Bldg. Prod. Div. Nat'l Gypsum Co.
      d. Marino Ware; Division of Ware Ind.
      e. Unimast Inc.
   2. Gypsum boards and related products:
      a. American Gypsum Co.
      b. G-P Gypsum
      c. National Gypsum Co.
      d. United States Gypsum Co.

2.2 FRAMING MATERIALS (WALLS AND PARTITIONS)

A. Steel studs and runners: ASTM C 645, fabricated from galvanized steel sheet, ASTM A525 G-60 coating with flange edges of studs bent back 90 deg. and doubled over to form 3/16" min. lip (return) and complying with the following requirements for min. thickness of base (uncoated) metal and for depth:
   1. Thickness: 20 ga minimum.
   2. Depth: 3 5/8" for all new gypsum board partitions unless otherwise indicated
   3. Steel rigid furring channels: ASTM C 645, fabricated from galvanized sheet steel, ASTM A525 G-60 coating, hat-shaped, depth and minimum 20 ga. base (un-coated) metal in depths indicated.

2.3 FRAMING MATERIALS (SUSPENDED AND FURRED CEILINGS & SOFFITS)

A. General: Provide components which comply with ASTM C 754 for materials and sizes unless otherwise indicated.

B. Concrete Inserts: Inserts designed for anchorage in existing concrete fabricated from corrosion-resistant materials, with holes or loops for attachment of hanger wires and capability to sustain, without failure, a load equal to 3 times that imposed by ceiling construction, as determined from testing per ASTM E 488, conducted by an independent testing laboratory.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

D. Hanger Rods and Flat Hangers: Mild steel, zinc coated.

E. Channels: 16 ga cold-rolled steel, 0.0598 inch minimum thickness of base (uncoated) metal and 7/16" wide flanges, protected with rust inhibitive paint for interior elements or hot-dip galvanized coating complying with ASTM A525, G-60, when used for exterior soffits, and as follows:
   1. Carrying Channels: 1 1/2" deep, 475 lbs/1000', uon.

2. Furring Channels: 3/4" deep, 300 lbs/1000', uon.

F. Steel Rigid Furring Channels: ASTM C 645, fabricated from galvanized steel sheet, ASTM A525, G-60 coating, hat-shaped, depth of 7/8", and minimum 20 ga base metal.

G. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.
1. All steel components fabricated from hot-dip galvanized steel sheet complying with ASTM A 525, coating designation G60.

2.4 GYPSUM BOARD

A. Gypsum Wallboard - High Impact Interior Panels.
1. Type: "Fiberock Aqua-Tough" interior panel **without paper face**, manufactured by United States Gypsum Co. Comply with ASTM D3273, and Class 1 Flame Spread, Smoke Development, and Fuel Contribution under E84 or approved equal.
2. Edges: Tapered.
3. Thickness: 5/8".
4. **At designated gypsum wallboard partitions provide Hi-Impact panels on indicated face from the floor to 9'-6" AFF** and standard gypsum wallboard above 9'-6". The joint between the two materials shall be a standard taped and spackled invisible joint.

B. Gypsum Wallboard - Regular
1. Type: ASTM C 36, Regular used generally except where called for to be fire-resistant (Type X or equivalent) for fire-resistant rated assemblies. Provide foil-backed for use as interior finish at exterior walls.
2. Edges: Tapered.
3. Thickness: 5/8".

2.5 TRIM AND ACCESSORIES

A. Corner bead and Edge Trim and other trim units for Interior Installation: Provide formed metal corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below, and are **designed for embedment in joint compound for a concealed appearance**.
1. Sheet steel coated with zinc by hot-dip or electrolytic processes.
2. Provide units suitable for exterior installation for use at the main entrance soffit work.

B. One-Piece Control Joint: Formed with v-shaped slot with slot opening covered with removable strip.

2.6 JOINT TREATMENT

A. General: Provide products by manufacturer of gypsum boards. Comply with ASTM C 475, ASTM C 840, and with manufacturer's recommendations for specific project conditions. All materials shall be certified asbestos-free.

B. Joint Tape: Manufacturer's standard paper type for specific interior or exterior use as required by project conditions.

C. Joint Compound: Vinyl-based ready-mixed type for interior use, and as follows:
1. Topping compound: Type specifically formulated for finishing drywall over taping compound with greatest bond strength & crack resistance.
2. For pre-filling gypsum board panels use type specifically formulated for this use.
3. For filling joints and treating fasteners of cement board use type specifically formulated for this use.

2.7 MISCELLANEOUS MATERIALS

A. General: Provide miscellaneous materials as produced or recommended by manufacturer of gypsum board and comply with referenced standard.

B. Screws: ASTM C 1002; self-drilling type; lengths as recommended by gypsum board manufacturer for project conditions.

C. Grout: ASTM C 475, setting-type joint compound of type recommended for grouting hollow metal door frames, or 100:1 gypsum plaster sand.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection: Verify that project conditions and substrates are appropriate to begin installation of gypsum drywall systems.

B. Work of this Section shall be coordinated with work of other Sections to assure the steady progress of all work of the contract. Obtain complete information regarding fixtures, grilles, registers, etc., to be used on work from Mechanical and Electrical trades prior to preparation of shop drawings. In no case shall work of other Sections be concealed until it has been inspected.

3.2 INSTALLATION OF METAL FRAMING

A. General: Comply with provisions of ASTM C 754 and ASTM C 840 except where exceeded by other requirements.

B. Steel Studs:
1. General: Install tracks and studs in accordance with manufacturer's recommendations and as follows:
a. Stud spacing: 16" on center, except as otherwise shown.
b. Tolerances: Steel framing to be installed plumb, level, square, straight and true to within a max. deviation of 1/8" for every 12'-0". The fastening surface of each framing or furring member shall be within 1/8" of each adjoining framing or furring member as measured along the plane of the faces and transversely between parallel members..

C. Supplementary Bracing:
1. Install supplementary bracing for support of fixtures, equipment, services, heavy

trim, furnishings, and similar work as the partitions are constructed. Provide 4" wide, 20 ga. sheet metal strips placed horizontally on both sides of the studs where indicated. Anchor the strips to each stud with two #12 screws.

3.3 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction. Align floor and ceiling tracks to assure plumb partitions. Secure track with suitable fasteners spaced 24" o.c. max.

B. Extend partition framing full height to structural supports or substrates above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

C. Partitions 10'-0" or more in height shall be braced horizontally, for lateral strength, with 3/4" channels wired or screw attached permanently to inside of studs. Channels shall be spaced not more than 6'-0" on center.

D. Where studs are not carried up to underside of structural supports or substrates above, the top runner shall be diagonally braced with pairs of metal struts spaced a maximum of 4'-0" on center. Strut shall be 1 5/8" studs, or acceptable equivalent members, rigidly attached to runner and structure above.

E. Install steel studs and furring in sizes indicated and spaced 16" oc unless otherwise noted. Secure each stud to both top and bottom runners with screws, or other accepted fastening method, through each stud flange and runner flange.

F. Attach hat-shaped furring channels horizontally at floor line and vertically at 16" oc to masonry or concrete substrates where furred wallboard finish is indicated. Secure channels through flanges with fasteners suitable for substrate indicated.

G. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction apposite to that of the flange.

H. Frame door openings to comply with details indicated. Attach vertical studs at jambs with screws directly to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Provide double full-height studs at each jamb with cripple studs within 1/2" of jamb studs to accommodate required control joints.
   2. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

I. Install thermal or acoustical insulation as follows:
   1. Maintain integrity of insulation over entire area to be insulated abutting edges and ends together, eliminating gaps between boards or batts.
   2. Carefully cut and fit insulation around pipes, conduits and other obstructions.
   3. Do not install batt insulation requiring compression in excess of 10%.
   4. Press batt insulation into place between studs to completely fill stud spaces from floor to structure above or to other heights as indicated.

3.4 INSTALLATION OF STEEL FRAMING FOR SUSPENDED CEILINGS

A. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to cast-in concrete inserts or other anchorage devices or fasteners as indicated.
   1. Do not attach hangers to metal deck tabs or to metal roof deck.
   2. Do not connect or suspend steel framing from ducts, pipes or conduit.
   3. Keep hangers and braces 2" clear of ducts, pipes and conduits.

B. Sway-brace suspended steel framing with hangers used for support.

C. Interior Gypsum Drywall Ceilings: Grid suspension system; attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLATION OF GYPSUM BOARD

A. General: Comply with ASTM C 840 and GA-216 except where exceeded by other requirements.

B. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24" in alternate courses of board.

C. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24".

D. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with a max. 1/16" open space between boards. Do not force into place.

E. Locate either edge or end joints over supports. Position boards so that like edges abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

F. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open edge of stud flange first.

G. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

H. Grout hollow metal door frames solid with sanded gypsum plaster. Grouting shall be done before adjacent studs are installed.

I. Isolate perimeter of non-load bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with ‘U bead edge trim. Seal joints with acoustical sealant.

3.6 FINISHING OF DRYWALL

A. General: Interior finish level is to be **level 4 in all spaces** per the Gypsum Construction

Handbook. Follow finishing procedures as described in Chapter 4, Finishing, of the handbook.

B. Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for finishes.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Finish interior gypsum wallboard by applying the following joint compounds in a minimum of 3 coats (not including pre-fill of openings in base), and sand between coats and after last coat. **Note that drywall joints must be filled and finished to the bottom of the boards (behind base).**
   1. Embedding and 1st coat: Setting-type joint compound.
   2. Fill (2nd) coat: Setting type joint compound.
   3. Finish (3rd) coat: Ready-mix drying-type all-purpose/topping compound.

E. Partial finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire resistance rating, or to act as air or smoke barrier.

F. Apply skim coat(s) of all purpose joint compound at a trowel applied consistency to the entire wall surface if required by the manufacturer in preparation for final finish listed in finish schedule.

3.7 CLEANING

A. Promptly remove any residual gypsum drywall materials from adjacent or adjoining surfaces, leaving spaces ready for subsequent finishing operations.

END OF SECTION 092216

DIVISION 9 – FINISHES

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda, apply to this section.

B. Extent of acoustical ceiling is shown and scheduled on drawings.
1. Consult reflected ceiling plans, mechanical and electrical drawings and coordinate extent and exact location of lights, outlets, diffusers, etc. occurring in the ceilings.

C. Types of acoustical ceiling include;
1. ACT – 2’ x 4’ acoustical tile suspended ceiling.
2. ACT – 2’ x 2’ acoustical tile suspended ceiling in the conference room.

1.2 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Specification Sections.

B. Product Data: Manufacturer's product specifications and installation instructions for each material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.
1. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.

C. **Shop Drawings: Submit complete reflected ceiling plans drawn to scale specifically for this project. Show all light fixtures, diffusers, registers, speakers or other ceiling mounted equipment as well as the grid system. Identify all areas of potential conflict and report to the Architect for resolution. The flanges of any ceiling mounted equipment shall be a minimum of 2" clear of the closest ceiling grid member.**

1.3 JOB CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, until wet-work in space is completed and nominally dry, until work above ceilings completed, and until ambient conditions of temperature and humidity will be continuously maintained at value near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 CEILING UNITS

A. Wet-formed mineral fiber substrate with washable and scrubbable finish, impact and scratch resistant.
   1. Manufacturer's standard fine-textured panel with the following characteristics.
      a. Type: III
      b. Form: 2
      c. Fire Performance: ASTM E84 compliance
      d. Color/light reflectance: White/LR (.81).
      e. NRC (.55).
      f. Edge detail: Square for use with 15/16" exposed Tee grid.
      g. Size: 24" x 48" x 5/8".
      h. Manufacturers: "Fissured"; by Armstrong, Inc..
   2. Manufacturer's standard fine-textured panel with the following characteristics.
      a. Type: III
      b. Form: 2
      c. Fire Performance: ASTM E84 compliance
      d. Color/light reflectance: White/LR (.81).
      e. NRC (.55).
      f. Edge detail: Square for use with 15/16" exposed Tee grid.
      g. Size: 24" x 24" x 5/8".
      h. Manufacturers: "Fissured"; by Armstrong, Inc..

2.2 CEILING SUSPENSION MATERIALS

A. Standard face double web steel suspension system: Manufacturers standard system roll-formed from prefinished cold-rolled steel sheet to produce structural members with 15/16" wide exposed faces; other characteristics as follows:
   1. System Design: Flush flanges forming flush surface; designed to receive square panel edges similar to "Prelude XL", 15/16", by Armstrong, Inc.
      a. Wall Moldings; Standard.
   2. Structural Classification: Intermediate-duty ASTM C 635 classifiable as Heavy-duty system by use of additional hangars.
   3. Finish: Painted white face.
   4. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, direct hung, unless otherwise indicated. Wire for hangers to be per ASTM A 641, Class 1 zinc coating, soft temper.
   5. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
      a. Armstrong, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine conditions under which acoustical ceiling and sound panel work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION - ACOUSTIC CEILINGS

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

C. Contractor shall maintain conditions of temperature and humidity at values near those indicated for final occupancy continuously from time that acoustical ceilings were installed until time of final occupancy to prevent sagging of ceiling tiles. Sagged ceiling tiles shall be replaced at the expense of the Contractor.

3.3 INSTALLATION

A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.

B. Install suspension systems to comply with ASTM C-636, with hangers supported only from building structure. Locate hangers near each end and space 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
   1. Secure wire hangers by looping and wire-typing, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.
   2. Increase carrying capacity of main runners to ASTM Heavy-duty rating by adding additional hangers spaced at reduced on-center dimensions so as to enable main runners to support a load of 16#/lin.ft.

C. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
   1. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.

D. Install acoustical panels in coordination with suspension system with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

3.4 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings and sound barriers, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot

be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095100

DIVISION 9 – FINISHES

SECTION 096519 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.
   1. Section Includes:
      a. Vinyl composition tile.
      b. Vinyl transition strips, moldings and accessories.
      c. Rubber wall base (provide where scheduled and at all base cabinets).
      d. Preparation of existing concrete slab to receive new resilient flooring installation and new and existing wall surfaces to receive new resilient base is part of the Work of this General Contract. The Contractor is to prepare floor slabs to receive new floor finishes. No additional funds will be authorized for any non structural slab repair work to prepare existing surfaces for new flooring installation. This includes, but is not limited to, filling voids and depressions, grinding high spots, scarifying to remove adhesive, etc., and skim coating total spaces if required for flat level surfaces or to resolve compatibility issues.

1.2 REFERENCES

A. ASTM F 710-98 -- Practice for preparation of concrete floors to receive resilient flooring.

B. ASTM F 1066-99 – Specification for vinyl floor tile and vinyl flooring.

C. ASTM F 1861-00 – Specification for rubber wall base.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's technical data for each product and accessory required. All material: tile, mastic and accessories; shall be certified asbestos-free.

C. Samples: Submit manufacturer's standard color boxes consisting of flooring samples, showing full range of colors and patterns available for each type of product required.

D. Shop Drawings: Submit shop drawings showing layout, finish colors, patterns and textures.

E. Maintenance Instructions: Submit manufacturer's recommended maintenance practices for each type of resilient product required.

1.4 QUALITY ASSURANCE

A. Manufacturer: Provide each type of resilient product by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: Class 1 rating per NFPA 253, 0.45 W/sq. Cm or greater when tested per ASTM E 648.
   2. Smoke Density: NFPA 258, Maximum specific optical density of 450 or less when tested per ASTM E 662.
   3. Flammability: Class A rating per ASTM E 84.

C. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

1.5 PROJECT CONDITIONS

A. Maintain minimum temperature of 65 degrees F in spaces to receive resilient flooring products for at least 48 hours prior to installation, and for not less than 48 hours after installation. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 degrees F in areas where work is completed.

B. Install resilient flooring products after other finishing operations, including painting, have been completed.

C. Do not install resilient flooring products over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond or moisture test.

1.6 GUARANTEE

A. The entire installation shall be guaranteed against defects in material and workmanship for a period of two years from date of acceptance of completion; said guarantee to include rippling, buckling, seam separation, etc. Any repair or replacement necessary shall be performed promptly at no charge to the Owner.

PART 2 - PRODUCTS

2.1 TILE FLOORING MATERIALS

A. Vinyl Composition Tile Flooring (VCT):
   1. Manufacturer: Tile from the following manufacturers shall be considered acceptable:
      a. Armstrong (Basis of Design)
      b. Mannington
      c. Johnsonite
      d. All tile shall be certified asbestos-free.
   2. Pattern or Style: Migrations, Bio Based Tile

3. Size and Gage: 12” x 12” x 1/8” thickness
4. Color: To be selected by Architect from manufacturer’s full range of standard colors.

2.2 RESILIENT BASE MATERIAL

A. Rubber Wall Base:
1. Manufacturer: Base from the following manufacturers shall be considered acceptable:
a. Johnsonite (Basis of Design)
b. Mannington
c. Armstrong

2. Height: 4 inches
3. Thickness: 1/8 inch
4. Style: Standard top-set cove
5. Finish: Matte (smooth & free from imperfections)
6. Color: Submit sample of black matching recent office renovation on the service level of the stadium for Architect and Owner review.
7. Provide coiled material with carefully field formed inside and outside corners subject to approval of Architect.

2.3 MISCELLANEOUS ACCESSORIES

A. Resilient Edge Strips: 1/8 inch thick, thermoplastic thru color vinyl, tapered or bullnose edge, not less than 1 inch wide.
1. Color: Matching rubber base.

B. Transition Strips (@ flooring of different thickness): thermoplastic thru color vinyl.
1. Color: Match rubber base.
2. Burke Mercer #152 or similar.

B. Adhesives (Cements): Waterproof, **chemical-set** type as recommended by resilient product manufacturer to suit material, substrate conditions, and as allowed by FEMA Technical Bulletin 2 (2008). Adhesives shall be certified asbestos-free.

C. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

D. Leveling and Patching Compounds: Latex types as recommended by manufacturer of resilient products.

E. Sealers or Polishes: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. The installer to inspect and accept substrate surfaces to determine that they are satisfactory. A satisfactory substrate is defined as one that is free of moisture and is smooth and free of cracks, holes, ridges, coatings preventing adhesive bond, and other

defects impairing performance or appearance. **All work required to create satisfactory substrate is part of the Work of this Contract whether assigned to this specific specification section or not.**

B. Perform bond or moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry, as well as to ascertain presence of curing compounds, or compatibility of curing/sealing compounds.

C. Do not allow resilient flooring work to proceed until substrates are satisfactory.

3.2 PREPARATION

A. Substrates:
1. Use leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes, and depressions in subfloors.
2. Remove coatings and foreign materials from substrates that would prevent adhesive bond, including curing compounds incompatible with resilient flooring adhesives by scarifying the surface of the substrate in accordance with recommendations of the flooring manufacturer.
3. Grind high spots or surface irregularities in the substrate using a grinding machine in accordance with recommendations of the flooring manufacture to produce a smooth non-telegraphing surface.
4. Reference Standard ASTM F 710-98 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. Concrete Moisture Test: Approved testing agency to perform moisture tests on all concrete floor slabs; three test locations for the first 1000 sf and one test per 1000 sf thereafter. The test shall be a calcium chloride test, as per ASTM F 1869. The test shall be conducted around the perimeter of the room, at columns and where moisture may be evident. Results of each test shall be submitted to the architect. If results exceed the specified limitations, installation shall not proceed until the problem has been corrected.
6. Concrete pH Test: Approved testing agency to perform pH tests on all concrete floor slabs. If pH is greater than 9, floor must be neutralized prior to beginning the installation.

B. Vacuum surfaces to be covered immediately prior to installation.

C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install resilient flooring using method indicated, in strict compliance with manufacturer's printed instructions. Extend resilient flooring into door reveals, closets and similar ancillary spaces.

B. Scribe, cut, and fit resilient flooring to permanent fixtures such as drains, pipes, clean-outs, floor mounted electrical outlets, etc.; and permanent columns, walls, and partitions.

At floor drains, clean-outs, access covers, etc. coordinate fixture installation so that installation is level compared to floor and at an appropriate elevation to receive flooring. Flash patch or skim as required for a smooth transition to these items.

C. Install resilient flooring continuous wall-to-wall under all built-in cabinet work.

D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

E. Tightly cement resilient flooring to substrate without open cracks, voids, or puckers at joints; telegraphing of adhesive spreader marks; or other surface imperfections. Evidence of the above imperfections will require removal, and re-laying of new resilient flooring material.

3.4 INSTALLATION OF VINYL TILE

A. Lay tile from center marks established with principal walls, discounting minor offsets, so that tiles at opposite edges of room are of equal width. Adjust as necessary to avoid use of cut widths less than ½ tile at room perimeters. **Continue vinyl composition tile to wall under all plastic laminate casework.**

B. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged if so numbered, or from same lot number or production run. Cut tile neatly around all fixtures. Broken, chipped or deformed tiles are not acceptable.
   1. Lay tile square to room axis, unless otherwise shown.
   2. Lay tile in “checkerboard” fashion with grain reversed in adjacent tiles.

3.5 INSTALLATION OF RUBBER BASE

A. Apply to walls, casework, and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with job formed corner units. Tightly bond base to substrate throughout length of each piece with continuous contact at horizontal and vertical surfaces.

3.6 INSTALLATION OF MISCELLANEOUS ACCESSORIES

A. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately upon completion of resilient flooring:
   1. Sweep or vacuum floor thoroughly.
   2. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed, to allow resilient flooring to become well-sealed in adhesive.

B. Damp mop floor, being careful to remove black marks and soil.

C. Remove excess adhesive or other surface blemishes, using appropriate cleaner recommended by manufacturer of resilient flooring product.

D. Protect flooring against damage during construction period to comply with directions of resilient flooring manufacturer. Protect against damage from rolling loads until substantial completion following installation by covering with plywood or hardboard. Use dollies to move equipment or furnishings across floors.
   1. Apply protective polish to resilient flooring surfaces free of soil, excess adhesive, and surface blemishes, unless manufacturer of resilient product recommends otherwise.
   2. Cover resilient flooring with undyed, untreated building paper until inspection for substantial completion.

END OF SECTION 096519

DIVISION 9 FINISHES

SECTION 096800 - CARPET

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereinafter.

1. The extent of carpeting is indicated on the drawings, and by specifications, and is defined to include carpet and accessories.
2. **Preparation of existing slab to receive new carpet installation is part of the Work of this General Contract. The Contractor is to prepare existing floor slabs to receive new floor finishes. No additional funds will be authorized for any non structural slab repair work to prepare existing surfaces for new flooring installation. This includes, but is not limited to, filling voids and depressions, grinding high spots, scarifying to remove adhesive, etc., and skim coating if required for compatibility or other issues.**

1.2 QUALITY ASSURANCE

A. Guarantee: The entire installation shall be guaranteed against defects in material and workmanship for a minimum period of 2 yrs. from the date of the complete installation.

B. Maintenance Materials: Deliver usable scraps of carpet to Owner's designed storage space, properly packaged (paper wrapped) and identified. Usable scraps are defined to include roll ends of less than 9'-0" length, and pieces of more than 2 sq. ft. area and more than 8" wide. Dispose of smaller pieces.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Samples, Carpeting: Submit 12" x 12" samples in triplicate of each carpet required, and 6" lengths of exposed edge stripping.

C. Shop Drawings: Seaming layout of carpet must be submitted to Architect for approval prior to installation. In general, no "T" seams, no seams at doors or entries, and no small piecing will be approved. Cross seams in corridors shall be kept to absolute minimum. Should installation be done not in conformity with approved layout, carpet will be removed at Contractor's expense and replaced according to seaming diagram.

D. Maintenance Instructions: Submit 3 copies of manufacturer's recommended maintenance practices for each type of carpet and accessory required.

E. Warranties: Submit written warranties specified in 1.2A above, signed by authorized official

of the carpet manufacturer.

1.4 PRODUCT DELIVERY AND STORAGE

A. Deliver carpeting materials in protective wrapping, and store inside, protected from weather, moisture and soiling.

1.5 QUALITY CONTROL

A. The Contractor shall provide quality control testing of the carpet proposed for use on the project to assure conformance with performance standards specified herein. All costs for testing, or retesting if required, shall be borne by the Contractor.

B. The testing shall be done by an independent testing agency, selected by the Contractor, but approved by the Architect. No testing shall be done until written approval of the testing agency has been issued.

C. Copies of test reports and certification to the results shall be submitted, in triplicate, to the Architect.

PART 2 - PRODUCTS

2.1 CARPET

A. CPT-1 shall be J+J Invision “Inception” (#7018) modular carpet tile in color “Basic Concept” (#1750);

1. Construction: Patterned loop
2. Backing: Nexus plank
3. Stitch Density: 12 / inch
4. Face Weight: 20 oz/sq. yd.
5. Density Factor: 7,460 oz/cu yd.
6. Fiber Type: Encore BCF w/ recycled content
7. Dye Method: Solution/Yard dyed
8. Soil/Stain Protection: ProTex
9. Product Size: 18” x 36” modular tile.
10. Smoke Density: < 450 (ASTM E-662).
11. Flooring Radiant Panel: Class 1 (mean ave. CRF: 0.45 w/sq cm of higher).

C. Written certification that the carpet meets all of the specifications of the carpet set forth in Paragraph 2.1 will be required prior to installation of carpet.

D. Warranties:

1.

a. Wear: Lifetime limited. No more than 10% face yarn loss by weight in normal use.
b. Dimensional stability: Lifetime limited: Modular tiles will not shrink, grow,

cup, or dome under normal use or atmospheric conditions.

d. Delamination: Lifetime limited. Guaranteed no delamination in normal use.

e. Tuft Bind: Lifetime limited. Average tuft bind, wet or dry, as tested in accordance with ASTM D-1335-67.

f. Standard Adhesive: Lifetime, limited. Guaranteed bond of carpet tiles to properly prepared substrate

2.3 CARPET ACCESSORIES

A. Carpet Edge Guard, Nonmetallic: Extruded or molded vinyl carpet to tile transition piece similar to Mercer #150 or #710, ADA compliant, black.

B. Installation Adhesive: Carpet adhesive of the lowest VOC emitting formulation recommended by the carpet manufacturer.

C. Seaming Cement: Chemical seaming adhesive or similar product of the lowest VOC emitting formulation recommended by carpet manufacturer, for taping seams and buttering cut edges at backing to form secure seams and prevent pile loss at seams.

D. Miscellaneous Materials: As recommended by manufacturers of carpet and other carpeting products; and selected by Installer to meet project circumstances and requirements.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

A. Installer must examine substrates for moisture content and other conditions under which carpeting is to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. **All work required to create satisfactory substrate is part of the Work of this Contract whether assigned to this specific specification section or not.**

B. Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting; vacuum clean immediately before installation. All required patching and filling shall be accomplished with a non-water-based underlayment as recommended by the carpet manufacturer.

C. Seal and prime all concrete with manufacturer's recommended floor primer in accordance with manufacturer's written installation instructions.

D. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

E. Carpet shall be unrolled and aired (off-gassed) at the installers warehouse or other off-site location for a minimum of 48 hours prior to delivery to the jobsite for installation.

3.2 INSTALLATION

A. During the carpet installation the Contractor shall continuously operate the building ventilation system at normal temperature and maximum outdoor air. This mode shall continue for a minimum of 72 hours following the installation. Temporary fans shall also be provided to supplement exhausting of the newly carpeted areas. Refer to the Carpet and Rug Institutes AStandard for Installation of Commercial Textile Floorcovering Materials-CRI 104" for additional information and as a standard for the installation.

B. Install carpet in accordance with manufacturer's written instructions.

C. Extend carpet continuous under cabinetwork, under open-bottomed obstructions and under movable flanges, and into alcoves and closets of each space.

D. Provide cut-outs where required, and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.

E. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.

F. Cut carpet with care to minimize ragged appearance resulting from cutting loops.

G. Apply manufacturer's seaming sealer to carpet edges at seams to secure a homogenous bond and chemical weld between the cushion backings. Clean seams with seam cleaner to remove all sealer from face of carpet.

H. Seams overlapped and double cut from face side with manufacturer's seam trimmer.

I. Roll carpet with 100 pound roller, starting from center of carpet and moving towards seam locations to remove all trapped air bubbles.

3.3 CLEANING AND PROTECTION

A. Remove debris, sorting pieces to be saved from scraps to be disposed of and vacuum. Vacuum with a high efficiency particulate air (HEPA) filtration vacuum.

. B. If significant construction work remains, after vacuuming cover carpet immediately with heavy reinforced kraft paper before proceeding. Keep protection in place until just prior to Substantial Completion Inspection.

C. After removing paper covering, vacuum carpet using machine described above. Remove spots and replace carpet where spots cannot be removed.

END OF SECTION 096800

DIVISION 9 – FINISHES

SECTION 099000 -- PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.
   1. Section includes:
      a. **Preparation of all existing and new surfaces to be finished and painted**.
      b. **Painting and finishing of all indicated existing surfaces and all new exposed interior items and surfaces and immediately adjoining to match.**
      c. Other painting as indicated in Specifications or on drawings including mechanical and electrical drawings.
   2. Section does not include:
      a. Prefinished items, unless indicated otherwise.
      b. Concealed surfaces, unless indicated otherwise.
      c. Finished metal surfaces.
      d. Operating parts.

1.2 REFERENCES

A. ASTM D 16-84 -- Standard Definitions of Terms Relating to Paint, Varnish, Lacquer and Related Products; 1984.

1.3 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

B. Special Coatings: Materials and methods of application requiring more than normal skills and techniques for mixing, handling and application and including applied materials used in prime, intermediate and finish coats.

1.4 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. To the maximum extent practicable, select a single manufacturer to provide all

materials required by this section, using additional manufacturers to provide systems not offered by the selected principal manufacturer.

2. For each individual system: Provide primer and other undercoat paint produced by same manufacturer as finish coat. Use only thinners approved by paint manufacturer and use only within recommended limits.

B. Applicator: Firm with successful experience in painting work similar in scope to the work of this project.

1. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to project site in original, new, unopened packages and containers bearing the manufacturer's name and label and the following information:

1. Name or title of material.
2. Manufacturer's stock number and date of manufacture.
3. Manufacturer's name.
4. Contents by volume for major pigment and vehicle constituents.
5. Thinning and application instructions.
6. Color name and number.
7. Handling instructions and precautions.

B. Storage and Handling:

1. Maintain containers in a clean condition, free of foreign materials and residue
2. Store materials in tightly covered containers at ambient temperature of between 45 degrees F minimum and 90 degrees F maximum in a well-ventilated area.
3. Ensure that storage area is neat and orderly. Remove oily rags and waste daily.
4. Take precautionary measures to prevent fire and health hazards per standards of manufacturer and applicable jurisdiction.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:

1. Apply water-based paint only when temperature of surface to be painted and surrounding air temperature are between 50 degrees F and 90 degrees F.
2. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F.
3. Do not apply paint in snow, rain, fog or mist or when relative humidity exceeds 85 percent or to damp or wet surfaces.
4. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated to temperature within manufacturer's specified limits during application and drying periods.
5. Provide lighting level of at least 80 footcandles measured mid-height at substrate surface.
6. Provide continuous ventilation and heating to prevent accumulation of hazardous fumes and to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and for 48 hours after application of finishes.

1.8 COORDINATION

A. General: Perform painting work in proper sequence with work of other trades to avoid damage to finished work. Coordinate painted finish of exterior wall, intake louvers for thru-wall heat pump units and other louvers with mechanical sections of this specification.

B. Primers: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates.
   1. Upon request, furnish information to other trades on characteristics of finish materials proposed for use.
   2. Provide barrier coats over incompatible primers or remove and reprime as required.
   3. Notify the architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products complying with requirements of the contract documents and made by one of the following:
   1. Benjamin Moore & Company (BMC).
   2. PPG Industries, Inc./Pittsburgh Paints (PPG).
   3. Sherwin Williams.

2.2 PRODUCTS

A. Provide one of the following under each paint type: **NOTE: Products listed from multiple manufacturers as basis of design only. Equivalent products from other approved manuf. listed above will be considered.**
   1. Interior alkyd enamel undercoat.
      a. BMC: Fresh-Start Alkyd Enamel Underbody 217.
      b. PPG: Speedhide Quick-Drying Enamel Undercoater 6-6.
   2. Interior alkyd enamel, odorless, semigloss.
      a. BMC: Satin Ipervo 235.
      b. PPG: Speedhide Low Odor Int. Enamel Wall & Trim Lo-Sheen-Oil 6-90.
   3. Interior latex primer:
      a. SW: Duration Interior Cross-linking Acrylic Latex
      b. PPG: Speedhide Quick-Drying Interior Latex Primer-Sealer 6-2.
   4. Interior latex, eggshell.
      a. SW: Duration Interior Cross-linking Acrylic Latex
      b. PPG: Speedhide Eggshell Latex Enamel 6-411.
   5. Block filler:
      a. BMC: Moore’s Masonry Sealer 377.
      b. PPG: Speedhide Latex Hi-Fill Block Filler 6-12.
   6. Concrete Sealer/Primer:
      a. BMC: Super-Spec Masonry High Build Primer N068
      b. PPG: Perma-Crete Alkali Resistant Primer 4-603

B. Provide heavy duty cleaner for all existing surfaces (and new surfaces if required):

1. a. Porter Coatings, Porterprep Heavy Duty Cleaner
   b. or equal.

2.3 MATERIALS

A. Material Quality:
   1. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Colors and Textures:
   1. Color scheme shall be in accordance with schedule provided by the Interior Designer, and all tinting and matching shall be to the satisfaction of the Interior Designer and Owner. **Refer to interior design drawings for specific paint colors.** The Contractor shall provide all facilities for comparison and adjustment of colors.

C. Color Pigments:
   1. Pure, non-fading paints to suit substrates and service indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces and conditions are ready for work per the product manufacturer.

B. Examine surfaces scheduled to be finished, prior to commencement of work.
   1. Report any unsatisfactory condition in writing to the contractor.
   2. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the applicator.
   3. Starting of painting work in any particular area will be construed as acceptance of surfaces and conditions within that area.

C. Do not paint over any code-required labels, equipment identification, performance rating, name or nomenclature plates.

3.2 PREPARATION

A. General: Prepare and clean each **existing and new substrate condition** in accordance with manufacturer's instructions and as herein specified. Adhesion to new and existing surfaces must be acceptable to manufacturer’s standards. Perform adhesion tests as necessary to assure compliance with acceptable requirements. Provide etching primers, scarify surface, etc. as required to achieve acceptable adhesion.
   1. Provide barrier coats or remove and re-prime incompatible primers as required.
   2. Clean surfaces before applying surface treatment.
      a. Remove oil and grease prior to mechanical cleaning.
      b. Coordinate cleaning and painting to ensure that no cleaning contaminants will fall onto newly painted areas.
   3. **Existing painted surfaces to receive new paint** that do not require barriers or etching primers shall be cleaned to receive new paint but are not required to receive a bottom (prime) coat. These surfaces require two finished coats only. In

addition to cleaning, remove all minor brackets, screws, etc. not indicated to remain. Remove all loose and flaking paint. Fill all voids, cracks, gouges and other surface defects prior to application of new finishes. Provide prime coat in any areas that have existing coatings removed by cleaning or covered with patch.

a. All existing surfaces to receive new paint shall be cleaned with a concentrated, water-based, biodegradable, zero VOC, strongly alkaline cleaner for the removal of oil, grease, dust, dirt and other contaminants prior to further surface preparation and prior to painting.
b. Follow manufacturer's recommendations for appropriate application, use, and rinsing. Protect adjacent finish materials during cleaning process.
c. Paint cleaned surfaces as soon as recommended after the rinse water has dried.

4. Existing surfaces with residual debris from removal of previous finishes or accessories; remove all traces of previous finishes and adhesives or attachment accessories. Fill all voids, cracks, gouges and other surface defects prior to application of new finishes.

B. Cementitious Materials:
1. Prepare cementitious surfaces to be painted by removing efflorescence, chalk, dust, dirt, grease and oils and any glazing. Fill all minor holes, cracks, open joints and other defects as part of the work of this section.
2. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests.
3. Do not paint over surfaces where test results exceed results permitted in manufacturer's printed directions.

C. Wood:
1. Clean wood surfaces with scrapers, mineral spirits and sandpaper, as required.
2. Sand smooth those finished surfaces exposed to view and dust off.
3. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of priming coat.
4. After priming, fill holes and imperfections in finish surfaces with putty, plastic wood-filler, or exterior caulking compound as applicable.
   a. Sand smooth when dried.
5. Prime, stain or seal wood required to be job-painted immediately upon delivery to project site.
   a. Prime all surfaces.
   b. Prime back side of wood items where applied directly to masonry, plaster or other wet wall construction.

D. Ferrous Metals:
1. Clean ferrous surfaces which are not galvanized or shop-coated, removing oil, grease, dirt, loose mill scale, or other foreign substances by means of solvents, wire brushing or sandblasting as required by manufacturer.
2. Touch up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications.
3. Clean and touch up with same type shop primer.

E. Gypsum Board:
1. Latex-fill minor defects.
2. Spot-prime defects after repair.

F. Galvanized Metals:
1. Clean metal surfaces to remove oil, dirt grease or other foreign substrates with wash coat recommended by galvanized metal paint manufacturer.
2. Clean and spot prime any rusted areas in accordance with ferrous metal requirements and galvanized metal paint manufacturer.

3.3 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.
1. Stir materials before application to produce a mixture of uniform density; stir as required during application.
2. Do not stir surface film into material.
3. Remove film and, if necessary, strain material before using.
4. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

3.4 APPLICATION

A. General:
1. Apply paint in accordance with manufacturer's directions.
2. Use applicators and techniques best suited for substrate and type of material being applied. **Spraying of paint will not be allowed without the permission of the Architect for each location.**
a. Surface imperfections will not be acceptable. **Areas to be painted must be clean and dust-free. Dust particles in the finish coat detectible to the touch and excessive are cause for rejection of the finish coat.**
b. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas.
1) If color or finish is not designated, the architect will select these from standard colors or finishes available.
c. Apply additional coats until paint film is of uniform finish, color and appearance.
1) Ensure that all surfaces receive a dry film thickness equivalent to those of flat surfaces.
d. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.
e. Paint interior surfaces of ducts where visible through registers or grilles with a flat non-specular black paint.
f. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
g. Finish exterior doors on tops, bottoms and side edges the same as exterior faces unless otherwise indicated.
h. Sand lightly between each succeeding enamel or varnish coat.
i. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:
1. Apply first-coat material to prepared surfaces as soon as practicable and before subsequent surface deterioration.
a. Do not recoat until paint has dried and each coat has been reviewed by the Architect.

C. Minimum Coating Thickness:
1. Apply materials at rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Prime Coats:
1. Apply prime coat on material which is required to be painted or finished and which has not been prime coated by others.

E. Completed Work:
1. Match approved samples for color, texture and coverage.
2. Remove, refinish or repaint work not in compliance with specified requirements. Thin spots, irregular surface quality and runs are not acceptable.

3.5 CLEANING AND PROTECTION

A. Cleaning:
1. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
2. Upon completion of painting work, clean window glass, hardware, and other paint-spattered surfaces.
a. Do not scratch or otherwise damage finished surfaces.

B. Protection:
1. Protect work of other trades against damage by painting and finishing work.
a. Correct any damage to the architect's satisfaction.
2. Provide "wet paint" signs as required to protect newly painted finishes.
3. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
4. At completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SYSTEMS

A. Gypsum Drywall:
1. Eggshell (Typical):
a. Bottom coat: Interior latex primer.
b. Two top coats: Interior latex, odorless, eggshell.
1) Provide 2.5 mils dry film thickness minimum.
2. Semigloss (At Toilet 1.18.08):
a. Bottom coat: Interior latex primer.
b. Two top coats: Interior latex, odorless, semigloss.
1) Provide 2.5 mils dry film thickness minimum.

B. Wood, vertical:
1. Semigloss, opaque
a. Bottom coat: Interior alkyd enamel undercoat.
b. Two top coats: Interior latex, semigloss.

C. Concrete Masonry Units (CMU):
1. Semigloss:
a. Bottom coat: Block filler.
b. Intermediate coat: Interior latex undercoat (tinted).

c. Top coat: Interior latex, odorless, semigloss.

D. Ferrous Metal, Shop Primed:
1. Semigloss, opaque:
a. Bottom coat: Shop primed.
b. Intermediate coat: Interior alkyd enamel undercoat.
c. Top coat: Interior alkyd enamel, odorless, semi-gloss.

F. Poured Concrete Walls:
1. Eggshell:
a. Bottom coat: Concrete Sealer
b. Intermediate coat: Interior latex undercoat (tinted)
c. Top coat: Interior latex, odorless, eggshell.

3.7 COLORS

A. Contractor shall match the existing colors present in the recently renovated office suite on the service level of the Stadium.

1. PT-1: Match Sherwin Williams Color “Mindful Gray” SW7016
2. PT-2: Match Owner’s Existing Standard Color for hollow metal doors and frames.
3. PT-3: Match Sherwin Williams Color “Dewberry” SW6552
4. PT-4: Match Sherwin Williams Color “Ceiling White”

END OF SECTION 099000

SECTION 101000 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.
   1. Section Includes:
      a. Access Doors.
      b. Countertop Brackets

1.2 SCOPE

A. Provide items as indicated on the drawings and as hereinafter described.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. General: Make submittals in accordance with requirements specified in Division 1.

C. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations for each major product required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

D. Shop Drawings: Submit complete shop drawings for installation including elevations and large scale sections showing mounting details.

E. Selection Samples: For initial selection of colors and textures, submit manufacturer's standard color sample selector consisting of actual product pieces, showing full range of colors and textures available.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain required products from a single manufacturer.
   1. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

PART 2 - PRODUCTS

2.1 ACCESS DOORS:

A. Provide as located in the drawings:

1.	Type:	CRS, recessed, non-rated, ceiling access door.
2.	Frame:	16 ga Galvanized Steel
	Door:	16 ga Galvanized Steel

3. Latch: Screwdriver Cam.
3. Size: 24” x 24”.
4. Hinge: Concealed Rod Hinge
5. Anchors: Stud Framing.
6. Finish: Factory-Primed

2.2 COUNTERTOP BRACKETS:

A. Provide as located in the drawings:

1. Manufacturer: Centerline Brackets
2. Type: Front Mounting Plus
3. Color: Black

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Provide all attachment clips, angles, fasteners, shields, blocking/reinforcement, and etc. necessary to complete installation of products to substrate indicated.

3.2 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.3 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at date of substantial completion.

END OF SECTION 101000

SECTION 101400 – ROOM SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.
   1. Section includes:
      a. Interior room signage.

1.2 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. General: Make submittals in accordance with requirements specified in Div. 1.

C. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations for each major product required. Include data substantiating that products to be furnished comply with requirements of the contract documents.

D. Shop Drawings: Submit complete shop drawings for fabrication and erection, including plans, elevations, and large scale details of typical sections and connections.
   1. Provide location and details of anchorage devices o be embedded in or fastened to other construction. Furnish templates if required for accurate placement.

E. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain required products from a single manufacturer for entire project to ensure continuity of color, design, and overall product consistency.
   1. Accessories: Provide accessory items only as produced or recommended by manufacturer of primary products.

PART 2 - PRODUCTS

2.1 INTERIOR SIGNS

A. Room Signage shall be mounted on the wall adjacent to the strike side of the door per ADA requirements.
   1. Coordinate with Maryland Stadium Authority personnel to provide Maryland Correctional Enterprises interior room signage to match existing room standards.
   2. Provide minimum one (1) sign for each room listed on the finish schedule, and allow for ten (10) percent additional signs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

3.3 CLEANING

A. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
   1. For cleaning, use only products and techniques acceptable to manufacturer or products being cleaned.

3.4 PROTECTION

A. General: Institute protective procedures and install protective materials as required to ensure that work of this section will be without damage or deterioration at date of substantial completion.

END OF SECTION 101400

DIVISION 10 – MISCELLANEOUS

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings, Terms and Conditions of the Contract of Division 0, General Requirements of Division 1, and all Sections of the Specifications apply to all work hereunder.
   1. Section Includes:
      a. Toilet paper dispensers.
      b. Paper towel dispenser.
      c. Grab bars.
      d. Mirrors.
      e. Soap dispensers.
      f. Lavatory waste & supply guard.

1.2 REFERENCES

A. ASTM A 153-82(87) -- Standard Specification for Zinc coating (Hot-Dip) on Iron and Steel Hardware; 1982 (Reapproved 1987).

B. ASTM A 167-88 -- Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1988.

C. ASTM A 366/A 366M-85 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1985.

D. ASTM A 527/A 527M-85 -- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality; 1985.

1.3 SUBMITTALS

A. Follow the procedures specified in Division 0 and Division 1 Specification Sections.

B. Product Data: Submit manufacturer's technical data and installation instructions for each toilet accessory.

C. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices and cutout requirements in other work.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid

interference and to ensure proper operation and servicing of accessory units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For each type of toilet accessory, obtain all items from a single manufacturer.

B. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
1. **Match manufacturer of existing accessory installed in recent office renovation on the service level of the stadium. Note: Multiple manufacturers may be present.**

2.2 MATERIALS

A. General:
1. Stainless steel: ASTM A 167, AISI Type 302/304, with polished No. 4 finish, 22 gage (0.034-inch) minimum, unless otherwise indicated.
2. Sheet steel: Cold-rolled, commercial quality ASTM A 366, 20 gage (0.040-inch) minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.
3. Galvanized steel sheet: ASTM A 527, G 60.
4. Galvanized steel mounting devices: ASTM A 153, hot-dip galvanized after fabrication.
5. Fasteners: Provide screws, bolts, and other devices as required.

B. Manufactured Units (Model numbers used for descriptive reference only):
1. Toilet paper dispenser:
   a. Kohler “Toobi” (#K-5672-CP)
   b. Finish: Polished Chrome
2. Paper towel dispenser (Wall-mounted):
   a. Bobrick (#B-262)
   b. Finish: Brushed stainless steel.
3. Grab bar:
   a. Kohler “Purist” (#K-11895-BS and #K-11896-BS)
   b. Finish: Brushed stainless steel
4. Mirror:
   a. Bobrick (#B-165 xxxx) **Provide custom-size mirror matching size shown in elevations on A2.01**
5. Soap dispenser (Deck mounted):
   a. Kohler (#K-1995-CP)
   b. Finish: Polished Chrome
6. Lavatory insulation kit (one kit at each lavatory):
   a. Kit to cover offset wheelchair strainer, p-trap, tailpiece, stop valve and supply tubes.
   b. Truebro ‘Lav Guard’ with all accessories.

2.3 FABRICATION

A. General: On exposed surface of accessories, only an unobtrusive stamped manufacturer's logo, approved by the architect, will be permitted. On unexposed interior surface or on back surface, provide manufacturer's name and accessory model number by means of a printed, waterproof label or stamped nameplate.

1. Surface mounted accessories: Fabricate units with tight seams and joints and with exposed edges rolled under so that no sharp edges occur. Provide concealed anchorage wherever possible. Hang doors or access panels with continuous steel piano hinges.
2. Recess mounted accessories: Coordinate locations with masonry work for proper rough-ins. Fabricate units of all welded construction, without mitered corners, except where otherwise indicated. Provide anchorage which is fully concealed when unit is closed. Hang doors or access panels with continuous stainless steel piano hinges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units in accordance with manufacturers' instructions, using fasteners as indicated, or if not indicated, which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level in locations indicated. Anchor firmly.

3.2 ADJUSTING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

3.3 CLEANING

A. Clean and polish all exposed surfaces after removing temporary labels and protective coatings.

END OF SECTION 102800

SECTION 123530 - WOOD CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes kitchenette and vanity cabinets.

B. Solid surface material countertops, backsplashes, and side splashes in the kitchenette and toilet room.

C. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 092216 "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring casework.

1.3 DEFINITIONS

A. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of casework installed directly against and completely concealed by walls or other casework, and tops of wall cabinets and utility cabinets.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors, interiors and sides of drawers, and bottoms of wall cabinets.

1.4 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and profiles and finishes for casework.

2. Include rated capacities, operating characteristics, profiles, and finishes for hardware and solid surfaces

B. Sustainable Design Submittals:

1. Provide documentation that composite panels and agrifiber products contain no added urea-formaldehyde resins and otherwise comply with the Maryland Stadium Authority's established Sustainable Purchasing Policy for Facility Alterations and Additions outlined in Section 016000.

2. Provide documentation that adhesives and sealants for countertops have VOC content less than the current VOC content limits of SCAQMD Rule #1168, or sealants used as fillers meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

C. Shop Drawings: For wood casework.

1. Include plans, elevations, details, and attachments to other work.
2. Show materials, finishes, filler panels, and hardware.
3. Indicate manufacturer's catalog numbers for casework.

D. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

E. Samples: For casework and hardware finishes.

F. Samples for Initial Selection: For casework, hardware finishes.

G. Samples for Verification: For the following:

1. Casework Finishes: 8-by-10-inch Samples for each type of casework finish.
2. Hardware: One full-size Sample of each type of exposed hardware in each finish required.
3. Countertop material, 6 inches square.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For casework.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate wood cabinetry and solid surface countertops countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Firm that is certified or by the casework Fabricator of countertops.

1.9 FIELD CONDITIONS

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

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

1. Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CABINETS

A. Subject to requirements of these specifications; products from the following manufacturers will be among those considered acceptable:

1. BASIS OF DESIGN: Kountry Wood Products, Mission Style
2. Approved equal, capable of replicating the construction, details, and finish of the cabinetry installed in the recently renovated office space on the service level of the Stadium

B. Quality Standard: Provide cabinets that comply with KCMA A161.1.

1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with KCMA A161.1.

C. Door and Drawer Face Style: Flush overlay; faces cover cabinet fronts.
1. Door and Drawer Fronts: 5/8-inch- thick, stained maple veneer-faced particleboard, stained maple veneer edge banding.
2. Basis of Design: “Carlisle” as manufactured by Echelon Cabinetry. Equivalent doors from other manufacturers will be considered.

D. Cabinet Style: Face frame.

1. Face Frames: 3/4-by-1-5/8-inch solid wood or manufacturer's standard.

E. Exposed Cabinet End Finish: Wood veneer.

F. Cabinet End Construction: 1/2-inch- thick particleboard, 3/8-inch- thick plywood, or manufacturer's standard.

G. Cabinet Tops and Bottoms: 1/2-inch- thick particleboard or 3/8-inch- thick plywood, or manufacturer's standard.

1. Fully support in rabbets in and secure to end panels, front frame, and back rail.

H. Back, Top, and Bottom Rails: 3/4-by-2-1/2-inch solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.

I. Wall-Hung-Unit Back Panels: 3/16-inch- thick plywood fastened to rear edge of end panels and to top and bottom rails, or manufacturer's standard.

J. Base-Unit Back Panels: 1/8-inch- thick hardboard fastened to rear edge of end panels and to top and bottom rails. or manufacturer's standard.

K. Front Frame Drawer Rails: 3/4-by-1-1/4-inch solid wood mortised and fastened into face frame, or manufacturer's standard.

L. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints, or manufacturer's standard.
2. Subfronts, Backs, and Sides: 3/4-inch- thick solid wood 1/2-inch- thick solid wood, or manufacturer's standard.
3. Bottoms: 1/4-inch- thick hardboard, or manufacturer's standard.

M. Shelves: 5/8-inch- thick particleboard, 1/2-inch- thick plywood, or manufacturer's standard.

N. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

O. Factory Finishing: Finish cabinets at factory.

2.2 CABINET MATERIALS

A. Hardwood Lumber: Kiln dried to 7 percent moisture content.

B. Softwood Lumber: Kiln dried to 10 percent moisture content.

C. Composite Wood Products: Products shall be made without urea formaldehyde.

D. Hardwood Plywood: HPVA HP-1.

E. Particleboard: ANSI A208.1, Grade M-2.

F. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.

G. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.

H. Hardboard: ANSI A135.4, Class 1 tempered.

I. Adhesives: Do not use adhesives that contain urea formaldehyde.

J. Exposed Materials:

1. Exposed Wood Species: Maple.

    a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
    b. Staining and Finish (At Kitchenette): Basis of design is “Espresso Satin Finish” as manufactured by Echelon Cabinetry, but sample finish shall be submitted for review to ensure that ultimate finish matches casework installed under recent office renovation on the service level of the stadium.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.

    a. Edge band exposed edges with a minimum of 1/8-inch- thick, solid-wood veneer edging of same species as face veneer.

4. Plastic Laminate (At Vanity): Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS and edgebanded, or manufacturer’s standard.
    a. Plastic-Laminate Edgebanding: Of same grade, pattern, color, and texture of plastic laminate as for faces.

        1) Color: Wilsonart “Cafelle” #7933-07

5. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

    a. Provide material finished on both sides for doors and drawer fronts.
    b. Provide PVC or polyester edgebanding on components with exposed or semiexposed edges.
    c. Colors: As indicated by manufacturer's designations.

6. Thermoformed-Vinyl-Faced Panels: MDF, milled to required shapes, with a thermoformed vinyl overlay applied in a vacuum or membrane press.

    a. Color: As indicated by manufacturer's designation.

K. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.

2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces or stained to be compatible with exposed surfaces.
3. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS, or manufacturer's standard.

    a. For backs of doors and drawer fronts faced with plastic laminate, provide same grade, pattern, color, and texture of plastic laminate as for faces.
    b. For face frames faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
    c. For shelves faced with plastic laminate, provide plastic-laminate edges of same grade, pattern, color, and texture of plastic laminate as for faces.
    d. Colors, Textures, and Patterns: As indicated by manufacturer's designations.

4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

    a. Provide material finished on both sides for shelves, dividers, drawer bodies, and other components with two semiexposed surfaces.
    b. Provide PVC or polyester edgebanding on components with semiexposed edges.
    c. Colors: As indicated by manufacturer's designations.

5. Vinyl-Faced Particleboard: MDF with vinyl film adhesively bonded to particleboard.

    a. Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces and on semiexposed edges.
    b. Colors, Textures, and Patterns: As indicated by manufacturer's designations.

L. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.3 CABINET HARDWARE

A. Pulls: Back-mounted decorative pulls.

1. Monument 160mm steel bar pull (#BP36572G10) as manufactured by Amerock

B. Hinges: Concealed European-style, self-closing hinges.

C. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

D. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

2.4 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

B. Manufacturers: Subject to requirements of these specifications; products from the following manufacturers will be among those considered acceptable:

1. BASIS OF DESIGN: Wilsonart
2. Approved equal, capable of replicating the construction, details, and finish of the solid surface countertops and backsplashes installed in the recently renovated office space on the service level of the Stadium
3. Colors and Patterns: “Adastra” Q3006 or exact match.

2.5 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch- thick, solid surface material with front edge built up to 1-inch-thick with same material.

D. Backsplashes: 1/2-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.6 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have VOC content less than the current VOC content limits of SCAQMD Rule #1168, or sealants used as fillers meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.

B. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.

B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten casework to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.

a. Fasteners: Use fasteners recommended by manufacturer for substrates present.

E. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

F. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

G. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

H. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

I. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

J. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

3.3 ADJUSTING AND CLEANING

A. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing.
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Concrete Slabs above Grade:

a. Galvanized-steel-pipe sleeves.

2. Interior Partitions:

a. Galvanized-steel-pipe sleeves.

END OF SECTION 220517

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.

B. Related Sections:
1. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
2. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block checks valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Grooved: With grooves according to AWWA C606.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

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

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Hammond Valve.
    c. Legend Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Red-White Valve Corporation.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Hammond Valve.
    c. Legend Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Red-White Valve Corporation.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Red-White Valve Corporation.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

3.6 SANITARY-WASTE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass/bronze with brass/bronze trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Pipe Stands

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.4 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm)high.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For domestic heater piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: White.
   b. Letter Color: Black.

2. Sanitary Waste Piping:

   a. Background Color: White.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, main shutoff valves in closet and main shut-off valves for the first and second floor restrooms. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches (38 mm), round.
   b. Hot Water: 1-1/2 inches (38 mm), round.

2. Valve-Tag Color:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Color:

   a. Cold Water: Black.
   b. Hot Water: Black.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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

E. PVC Jacket Adhesive: Compatible with PVC jacket.

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

2.3 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. <Insert manufacturer's name; product name or designation>.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Apply adhesives and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches (50 mm)] [4 inches (100 mm)] o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FINISHES

A. Insulation with ASJ: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be one of the followings:
   a. Flexible Elastomeric: 1 inch (25 mm) thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot Water and recirculating pipes:

1. Insulation shall be one of the followings:
   a. Flexible Elastomeric: 1 inch (25 mm) thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Piping, Concealed:

1. None.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Aboveground domestic water pipes and fittings inside buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International.
e. Matco-Norca.
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).

4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

L. Install sleeves for piping penetrations of walls, ceilings, and floors.

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping shall be the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought copper, solder-joint fittings; and brazed joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water-hammer arresters.
2. Trap-seal primer valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Watts Drainage Products.
   f. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.4 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. MIFAB, Inc.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water-hammer arresters in water piping according to PDI-WH 201.

B. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Supply-type, trap-seal primer valves.

3.3 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service:

1. Notify Construction Manager and Owner no fewer than one week in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class (es).

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

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

a. ANACO-Husky.
b. Fernco Inc.
c. Matco-Norca, Inc.
d. MIFAB, Inc.
e. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

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

a. ANACO-Husky.
b. Clamp-All Corp.
c. MIFAB, Inc.
d. Mission Rubber Company; a division of MCP Industries, Inc.
e. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

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

    a. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company; a division of MCP Industries, Inc.

    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

4. Pressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.
        2) Dresser, Inc.
        3) Smith-Blair, Inc.; a Sensus company.
        4) Viking Johnson.

    b. Standard: AWWA C219.
    c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    d. Center-Sleeve Material: Manufacturer's standard.
    e. Gasket Material: Natural or synthetic rubber.
    f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Capitol Manufacturing Company.
        2) Hart Industries International, Inc.
        3) McDonald, A. Y. Mfg. Co.
        4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        5) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
        3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Capitol Manufacturing Company.
        2) Hart Industries International, Inc.
        3) McDonald, A. Y. Mfg. Co.
        4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        5) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.
        3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
        4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric Nipples:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Elster Perfection.
        2) Grinnell Mechanical Products.
        3) Matco-Norca, Inc.
        4) Precision Plumbing Products, Inc.
        5) Victaulic Company.

    b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Install waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

L. Install steel piping according to applicable plumbing code.

M. Plumbing Specialties:
1. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples/unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges, flange kits, nipples.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 6 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Underground, soil, waste, and vent piping NPS 6 and smaller shall be the following:

1. Extra heavy, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous sanitary drainage piping specialties.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Closure: Brass plug with straight threads and gasket.
6. Adjustable Housing Material: Cast iron with setscrews or other device.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
8. Frame and Cover Shape: Round.
9. Top Loading Classification: Heavy Duty.

B. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.

3. Body: Hub-and-spigot, cast-iron soil pipe T-branch/Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded cast-iron plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, stainless-steel cover plate with screw.
7. Wall Access: Round/Square, stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Zurn Plumbing Products Group

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round.
12. Top Loading Classification: Medium Duty.
13. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
14. Trap Material: Cast iron.
15. Trap Pattern: Deep-seal P-trap.
16. Trap Features: Trap-seal primer valve drain connection.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps for all floor drains:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

D. Install deep-seal traps on floor drains.

E. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224213– COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Fixture supports.
5. Water closets.
6. Lavatories.

B. Related Sections include the following:
1. Division 22 Section "Domestic Water Piping Specialties" for floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

A. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

B. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects", for fixture materials that will be in contact with potable water.

D. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

E. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

F. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Faucets: ASME A112.18.1.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
5. NSF Potable-Water Materials: NSF 61.
6. Pipe Threads: ASME B1.20.1.
7. Supply Fittings: ASME A112.18.1.
8. Brass Waste Fittings: ASME A112.18.2.

G. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Manual-Operation Flushometers: ASSE 1037.
4. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of plumbing fixtures that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures of unit shell.
    b. Faulty operation.
    c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FAUCETS

A. Faucets: See Plumbing Fixtures and accessories on Drawings.

2.2 FLUSHOMETERS

A. Flushometers: See Plumbing Fixtures and accessories on Drawings.

2.3 TOILET SEATS

A. Toilet Seats: See Plumbing Fixtures and accessories on Drawings.

2.4 WATER CLOSETS

A. Water Closets: See Plumbing Fixtures and accessories on Drawings.

2.5 LAVATORIES

A. Lavatories: See Plumbing Fixtures and accessories on Drawings.

2.6 KITCHEN SINKS

A. Kitchen Sinks: See Plumbing Fixtures and accessories on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

C. Install wall-mounting fixtures with tubular waste piping attached to supports.

D. Install counter-mounting fixtures in and attached to casework.

E. Install fixtures level and plumb according to roughing-in drawings.

F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

I. Install toilet seats on water closets.

J. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

K. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

L. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts.

M. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

N. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division Section 220518.

O. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase, general-purpose, factory installed motors.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Equipment supports.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
1. Carpenter & Paterson, Inc.
2. National Pipe Hanger Corporation.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
5. Piping Technology & Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.2 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Use hangers and supports with galvanized metallic coatings for equipment that will not have field-applied finish.

B. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.

C. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

D. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Spring hangers.

1.3 DEFINITIONS

A. IBC: International Building Code.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. California Dynamics Corporation.
2. Isolation Technology, Inc.
3. Kinetics Noise Control.
4. Mason Industries.
5. Vibration Eliminator Co., Inc.

B. Spring Hangers for air handling unit: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 ADJUSTING

A. Adjust active height of spring isolators.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Duct labels.

1.3 ACTION SUBMITTALS

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

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For air supply and fresh air ducts.
2. Green: For exhaust- and return-air ducts.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems for the new air handling unit and part of the existing air handling unit that serves the area of renovation in addition with the hot water and chilled water flow serving the AHU-6.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.

3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. TAB Conference: Meet with engineer/Architect, Owner, Construction Manager, Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:
   a. The TAB plan.
   b. Coordination and cooperation of trades and subcontractors.
   c. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on all air distribution systems on the second floor have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS (same for single zone VAV type air handling unit)

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

e. Report the cleanliness status of filters and the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fan and Equipment with Fans: Plus or minus 10 percent.
2. Toilet Exhaust Fans: Plus 5 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for supply-air, static-pressure controller.
    g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

F. Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated air flow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual air flow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 5 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Construction Manager.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
3. Owner/Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and return air.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

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

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-03/11-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

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

2.3 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    b. Vimasco Corporation; 713 and 714.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   c. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick,[1/2 inch (13 mm) wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   1) AGM Industries, Inc.; CWP-1.
   2) GEMCO; CD.
   3) Midwest Fasteners, Inc.; CD.
   4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   1) AGM Industries, Inc.; CHP-1.
   2) GEMCO; Cupped Head Weld Pin.
   3) Midwest Fasteners, Inc.; Cupped Head.
   4) Nelson Stud Welding; CHP.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   1) AGM Industries, Inc.; RC-150.
   2) GEMCO; R-150.
   3) Midwest Fasteners, Inc.; WA-150.
   4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section Penetration Firestopping.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be

limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and return air.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-air duct (except as noted on drawings for use of duct liner):
1. Mineral-Fiber Blanket: 1-1/2 inches thick (R-6) and 0.75-lb/cu. ft. (12-kg/cu. M nominal density.

B. Supply air ceiling diffuser cover plate/housing exposed in ceiling plenum shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. (12-kg/cu. M nominal density.

C. Outside-air duct (replace any damaged existing outside air duct in the renovated area):
1. Mineral-Fiber Blanket: 2 inches thick (R-8) and 0.75-lb/cu. ft. (12-kg/cu. M nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes mechanical insulation for pipe, including the following:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Application at linkages of control devices.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000(Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied

jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products:

a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products:

a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products:

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.
e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
d. Marathon Industries, Inc.; 550.
e. Mon-Eco Industries, Inc.; 55-50.
f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:

a. Childers Products, Division of ITW; CP-52.
b. Foster Products Corporation, H. B. Fuller Company; 81-42.
c. Marathon Industries, Inc.; 130.
d. Mon-Eco Industries, Inc.; 11-30.
e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
4. Color: White.

2.7 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Products:

a. Childers Products, Division of ITW; CP-76.
b. Foster Products Corporation, H. B. Fuller Company; 30-45.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.
f. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants:

1. Products:

    a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products:

    a. Childers Products, Division of ITW; Metal Jacketing Systems.
    b. PABCO Metals Corporation; Surefit.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
b. Compac Corp.; 110 and 111.
c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch.in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
b. Compac Corp.; 120.
c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils .
4. Adhesion: 100 ounces force/inch.in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

a. Products:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products:

1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Base plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers:

a. ACS Industries, Inc.
b. C & F Wire.
c. Childers Products.
d. PABCO Metals Corporation.
e. RPR Products, Inc.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Mix insulating cements with clean potable water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thickness required for each item of equipment, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thickness.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies according to Section "Through-Penetration Firestop Systems."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

C. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thickness are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Below-grade piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Indoor piping insulation shall be in accordance with 2015 International Energy Conservation Code (IECC).

B. Heating-Hot-Water Supply and Return piping:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber with Vapor Barrier, Minimum R-4, Preformed Pipe, Type I: 1.5 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:
   a. Mineral-Fiber with Vapor Barrier, Minimum R-4, Preformed Pipe, Type I: 2.0 inch thick.

C. Chilled Water and Brine, above 40 Deg F:

1. NPS 2 and Smaller: Insulation shall be one of the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 1 inch thick.

D. Condensate and equipment drain piping:

1. All Pipe Sizes: Insulation shall be the following:

   a. Flexible Elastomeric: 1/2 inch thick.
   b. Mineral fiber type I: 1/2 inch thick with ASJ.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Heating Hot Water and chilled water Piping, Concealed:

1. All Service Jacket for Fiberglass insulation.

END OF SECTION 230719

SECTION 230923 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Contract Provisions, Special Provisions, General Provisions, and Terms and Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components.

B. Contractor shall refer to the sequence of operation on the drawings.

C. Close coordination is required with the existing building automatic control system to fully implement the sequence of operation.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. BMS: Building Automation Control

C. VO: Input/output.

D. BACnet: A control network technology platform for designing and implementing interoperable control devices and network s.

E. MS/TP: Master slave/token passing.

F. PC: Personal computer.

G. PID: Proportional plus integral plus derivative.

H. RTD: Resistance temperature detector.

1.4 SEQUENCE OF OPERATION: Refer to Controls Drawings.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including flow characteristics.
7. DDC System Hardware:
    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic ·diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
8. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

F. Qualification Data: For Installer and manufacturer.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Special Provision "Operation and Maintenance Data," include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended , and

calibration tolerances.

5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article l 00, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 135 for DOC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONTROL SYSTEM

A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token- passing network and programmed to control mechanical systems. Refer to the sequence of operation showing the requirement for DDC control panels and interface with the network to the existing BAS system. This include updating the existing dynamic color graphics with each mechanical component, and control device depicted by point-and-click graphics. The existing BAS systems is Andover Bacnet controls front end with Johnson controllers, Andover controllers and FX controllers in line.

2.3 DDC EQUIPMENT

A. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V de), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V de) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-points, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

B. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with l 00-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

C. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of l 000 V.
2. Maximum response time of l 0 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient 10 capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage 1/0 communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.5 SYSTEM SOFTWARE FEATURES

A. General

1. All necessary software to form a complete operating system as described in this specification and sequence of operation on drawings shall be provided.

B. Graphics Display: Color graphic floor plan displays and system schematic for each piece of mechanical equipment shown on plans shall be provided.

C. Custom Process Programming Capability: DDC panels shall be able to execute custom, job-specific processes defined by the operator, to automatically perform calculations and special control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
   a. Any system-measured point data or status.
   b. Any calculated data.
   c. Any results from other processes.
   d. User-Defined Constants.
   e. Arithmetic functions (+, -, *, I square root, exponential, etc.).
   f. Boolean logic operators (and, or, exclusive or, etc.).
   g. On-delay/Off-delay/One-shot timers.
2. Process Triggers: Custom processes may be triggered based on any combination of the following:
   a. Time interval.
   b. Time of day.
   c. Date.
   d. Other processes.
   e. Time programming.
   f. Events (e.g., point alarms).
3. Dynamic Data Access: A single process shall be able to incorporate measured or calculated data from any and all other DDC panels on the local area network. In addition, a single process shall be able to issue commands to points in any and all other DDC panels on the local area network.
4. Advisory/Message Generation: Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device, buffer the information in a follow- up file, or cause the execution of a dial-up connection to a remote device such as a printer.
5. Custom Process Documentation: The custom control programming feature shall be self-documenting. All interrelationships defined by this feature shall be documented via graphical flowcharts and English language descriptors.

E. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each DDC panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the DDC panel's ability to report alarms be affected by either operator activity at the local VO device, or communications with other panels on the network.

1. Point Change Report Description: All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
2. Prioritization: The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Each DDC panel shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point. The user shall also be able to define under which

conditions point changes need to be acknowledged by an operator, and/or sent to follow-up files for retrieval and analysis at a later date.

F. Historical Data and Trend Analysis: A variety of Historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways:

1. Continuous Point Histories: Standalone DDC panels shall store Point History Files for all analog and binary inputs and outputs. The Point History routine shall continuously and automatically sample the value of all analog inputs at half hour intervals. Samples for all points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point History Files for binary input or output points and analog output points shall include a continuous record of the last ten status changes or commands for each point.
2. Data Storage and Archiving: Trend data shall be stored at the Standalone DDC panels and uploaded to hard disk storage when archival is desired. Uploads shall occur based upon either user-defined interval, manual command, or when the trend buffers become full. All trend data shall be available in disk file format compatible with Third Party personal computer applications.

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Manufacturers:
   a. BEC Controls Corporation.
   b. Ebtron, Inc.
   c. Heat-Timer Corporation.
   d. I.T.M. Instruments Inc.
   e. MAMAC Systems, Inc.
   f. RDF Corporation.
2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
2. Averaging Elements in Ducts: 36 inches long, flexible or 18 inches long, rigid; use where prone to temperature stratification or where ducts are larger than I0 sq. ft..
3. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Thermometer: Concealed.
   d. Orientation: Vertical.
5. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
6. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:
   a. BEC Controls Corporation.
   b. MAMAC Systems, Inc.
   c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 24 inches long, rigid or 24 feet long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Thermometer: Concealed.
   d. Orientation: Vertical.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Pressure Transmitters/Transducers:

1. Manufacturers:
   a. BEC Controls Corporation.
   b. General Eastern Instruments.
   c. MAMAC Systems, Inc.
   d. ROTRONIC Instrument Corp.
   e. TCS/Basys Controls.
   f. Vaisala.
2. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
3. Differential-Pressure Switch: Snap acting, with pilot-duty rating and with suitable scale range and differential.
4. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

E. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Adjusting Key: As required for calibration and cover screws.
3. Capability to override the occupancy schedule.

2.7 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with

adjustable range of 0- to 5-inch wg.

B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.0l, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirement s.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.8 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Special Provision "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Retum Motors for Valves Larger Than NPS 2-112: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:
   a. Belimo Aircontrols (USA), Inc.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return) : 24 or 120-V ac.
8. Power Requirement s (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V de or 4 to 20 mA, and 2- to 10-V de position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 deg F.
11. Run Time: 30 seconds.
    a. Two-way Modulating: either the value specified above or twice the load pressure drop, whichever is more.
    b. Three-way Modulating: Twice the load pressure drop. But not more than value specified above.
12. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.9 DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- mm1mum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 m. x lbf; when tested according to AMCA 500D.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that ductwork, piping, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Gymnasium.
4. Where indicated.

E. Install automatic dampers according to Special Provision "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Special Provision "Identification for HVAC Piping and Equipment."

H. Install hydronic instrument wells, valves, and other accessories according to Special Provision "Hydronic Piping."

I. Install duct volume-control dampers according to Sections specifying air ducts.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Special Provision "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Special Provision "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Special Provision "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for

vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Check instruments for proper location and accessibility.
2. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
3. Check instrument tubing for proper fittings, slope, material, and support.
4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
5. Check temperature instruments and material and length of sensing elements.
6. Check control valves. Verify that they are in correct direction.
7. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare VO capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:

   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
   f. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
   g. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
   h. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
   i. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
   j. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
   k. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners , following manufacturer's recommended procedure , so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Special Provision "Demonstration and Training."

END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Chilled water piping.
3. Condensate-drain piping.
4. Air-vent piping.
5. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Chemical treatment.

B. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
2.

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

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 200 deg F.
2. Chilled-Water Piping: 150 psig at 73 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Air-Vent Piping: 200 deg F.
5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.

1. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting.
2. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

C. Copper or Bronze Pressure-Seal Fittings:

1. Housing: Copper.
2. O-Rings and Pipe Stops: EPDM.
3. Tools: Manufacturer's special tools.
4. Minimum 200-psig working-pressure rating at 250 deg F.

D. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

E. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe and Tube Materials and Application Schedule

System	Pipe Material	Fitting Material	Joint Material
Heating Water & Chilled water Piping	2" and smaller: Steel Pipe, ASTM A53, grade B, Schedule 40, black steel.	2" and smaller: Malleable Iron, Threaded, ANSI B16.3, Class 150. Threads per ANSI B.1.20.1, and threadolets.	Threaded: American Standard for pipe threads, ANSI B2.1
	2" and smaller (Contractor's Option: ASTM B88, Type L, Seamless, Water Tube, hard-drawn temper).	2" and smaller (Contractor's Option): Copper Tube; ASME B16.22, wrought copper, or copper alloy, solder joint, 150 lb.	ASTM B32, alloy Sb5 (95 percent tin and 5 percent antimony), with 0.2 percent maximum load content.
Air Conditioning Condensate and Equipment Drains	Copper Drainage Tube; DWV, ASTM B306.	Wrought copper and bronze drainage fittings, ASNI B16.29.	Soldered; ASTM B32, Alloy Sb5 (95 percent tin and 5% antimony), with 0.2 percent maximum lead content.

B. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K (Type A), annealed-temper copper tubing with soldered or flared joints.

C. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523 "General Duty Valves for HVAC Piping,"

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.

U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m).
2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m).
3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m).
4. NPS 2 (DN 50): Maximum span, 10 feet (3 m).
5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m).
6. NPS 3 (DN 80) and Larger: Maximum span, 12 feet (3.7 m).

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/4 ((DN 32):)Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 3 (DN 80) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Set makeup pressure-reducing valves for required system pressure.
3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
4. Set temperature controls so all coils are calling for full flow.
5. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Reinforcement and spacing.

4. Seam and joint construction.
5. Penetrations through fire-rated and other partitions.
6. Dampers, turning vanes, and access doors and panels.
7. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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

a. Lindab Inc.

b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Aeroflex USA Inc.

b. Armacell LLC.
c. Rubatex International, LLC

3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches) from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.
c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through and electrical equipment rooms and enclosures.

J. Where ducts pass through fire-rated interior partitions, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Conditioned Space, Downstream of air handling unit: Seal Class B.
3. Conditioned Space, Exhaust Ducts: Seal Class A.
4. Conditioned Space, Return-Air Ducts: Seal Class B.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:

      a. Entire supply air ducts in renovated area.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 DUCT CLEANING

A. Clean new duct systems in renovated area before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air handling unit internal surfaces and components including mixing box, coil section, condensate drain pans and filter sections.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes.

6. Supply-air ducts and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and re-inspect ducts.

3.8 FIELD QUALITY CONTROL

A. Gravimetric Analysis: Sections of metal-duct system, chosen randomly by Owner/Architect, should be tested for cleanliness according to NADCA Vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal-duct system shall be recleaned and reverified.

B. Report results of tests in writing.

3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts downstream of air handling unit:

a. Pressure Class: Positive 2-inch wg .
b. Minimum SMACNA Seal Class: B.

c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round: 3.

B. Return Ducts:

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Downstream of air handling unit:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Flexible ducts.
7. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. Nailor Industries Inc.
e. Ruskin Company.

2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Frame: Hat-shaped, 0.094-inch thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

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

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.

B. Frames:

1. Hat shaped.
2. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

E. Bearings:

1. Oil-impregnated bronze.
2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FLANGE CONNECTORS

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

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 DUCT-MOUNTED ACCESS DOORS

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

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

2.7 FLEXIBLE CONNECTORS

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

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.8 FLEXIBLE DUCTS

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

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-value: Min R-6.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
2. Upstream and downstream from turning vanes.
3. Control devices requiring inspection.
4. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. Head and Hand Access: 18 by 10 inches (460 by 250 mm).

2. Head and Shoulders Access- for larger supply air ducts within the vertical shafts: 21 by 14 inches (530 by 355 mm). Provide fire rated access doors at the shaft wall opening and access doors at the ducts.

J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Flexible duct shall be supported from the building structure with 1” wide sheet metal strap with sheet metal saddle that covers one-half the circumstance of the outside diameter of flexible duct.

L. Install duct test holes where required for testing and balancing purposes.

M. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.

END OF SECTION 233300

SECTION 233713 - AIR DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Adjustable Bar Register:

1. Products:
   a. Carnes.
   b. Krueger.
   c. METALAIRE, Inc., Metal Industries Inc.
   d. Titus.
   e. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Adjustable vertical spaced 3/4 inch apart.
5. Rear Blade Arrangement: Adjustable horizontal spaced 3/4 inch apart.
6. Frame: 1-1/4 inches wide.
7. Mounting Frame: surface mounted.
8. Mounting: Countersunk screw.
9. Damper Type: adjustable opposed-blade assembly.

B. Fixed Face Grille :

1. Products:
   a. Krueger.
   b. Nailor Industries of Texas Inc.
   c. Titus.
   d. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: 38 deg, fixed deflection, horizontal blades.
5. Frame: 1-1/4 inches wide.
6. Mounting Frame: Surface mounted.
7. Mounting: Countersunk screw.

C. Eggcrate Face Grille :

1. Products:

   a. A-J Manufacturing Co., Inc.
   b. Anemostat, a Mestek Company.
   c. Carnes.
   d. Krueger.
   e. Nailor Industries of Texas Inc.
   f. Titus.
   g. Tuttle & Bailey.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Frame: 1-1/4 inches wide.
6. Mounting Frame: Surface mounted.
7. Mounting: Countersunk screw.

D. Perforated Face Grille :

1. Products:
   a. Krueger.
   b. Nailor Industries of Texas Inc.
   c. Titus.
   d. Tuttle & Bailey.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core.
5. Frame: 1-1/4 inches wide.
6. Mounting Frame: Surface mounted.
7. Mounting: Countersunk screw.

2.3 CEILING DIFFUSER OUTLETS

A. Rectangular and Square Ceiling Diffusers :

1. Products:
   a. Krueger.
   b. METALAIRE, Inc., Metal Industries Inc.
   c. Titus.
   d. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: As indicated on drawings.
5. Face Style: Three cone.
6. Mounting: Surface.
7. Pattern: Adjustable.
8. Dampers: Radial opposed blade.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237313 - INDOOR, AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Factory-assembled, indoor air-handling units with limited features.

1.3 ACTION SUBMITTALS

A. Product Data: For each air-handling unit.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Filters with performance characteristics.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports:

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1. Filters: one set for each air-handling unit.
2. Gaskets: One set for each access door.

1.7 COORDINATION

A. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 INDOOR, BASIC AIR-HANDLING UNIT MANUFACTURERS

2.3 MANUFACTURERS

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

1. Trane
2. Carrier
3. Dailkin

2.4 UNIT CASINGS

A. General Fabrication Requirements for Casings;

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant. Hermetically seal at each corner and around entire perimeter.
4. Base Rail:

    a. Material: Galvanized steel.
    b. Height: 4 inches.

B. Double Wall:

1. Outside Casing Wall: Galvanized steel, minimum 2 inch thick, with manufacturer's standard finish.
2. Inside Casing Wall: Galvanized steel, solid, minimum 2 inch thick.

3. Floor Plate: The unit floor shall be of sufficient strength to support a 300.0 lb load during maintenance activities and shall deflect no more than .005 inch per inch of panel span
4. when sitting on a support structure.
5. Casing Insulation:

    a. Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft^2*h*^oF/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented. Panel insulation shall comply with NFPA 90A.
    b. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roofs of air-handling unit.

C. Static-Pressure Classifications:

1. For Unit Sections Upstream of Fans: Minus 1-inch wg.
2. For Unit Sections Downstream and Including Fans: 2.343-inch wg.

D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Panels and Doors:

1. Panels:

    a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
    b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
    c. Gasket: Neoprene, applied around entire perimeters of panel frames.

2. Doors:

    a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
    b. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
    c. Gasket: Neoprene, applied around entire perimeters of frame.
    d. Size: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components. Doors shall be maximum height and width allowed by the unit section.

3. Locations and Applications:

    a. Fan Section: Doors.
    b. Coil Section: Panels.
    c. Access Section: Doors.
    d. Access Sections Immediately Upstream and Downstream of Coil Sections: Doors.
    e. Filter Section: Doors large enough to allow periodic removal and installation of filters.

F. Condensate Drain Pans:

1. Construction:

a. Insulated assembly of polymer material or stainless steel.

2. Drain Connection:

a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
b. Minimum Connection Size: NPS 3/4.

3. Slope: Minimum 0.125 in./ft. (10 mm/m) slope, to comply with ASHRAE 62.1 in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends), and to direct water toward drain connection.
4. Length: Extend drain pan downstream from leaving face to a distance of one half of the installed vertical dimension of the water producing device or assembly to comply with ASHRAE 62.1.
5. Width: Entire width of water producing device.
6. Depth: A minimum of 1 1/2 inches deep.

2.5 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: With field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. The fan shall be a double-width, double-inlet, multi-blade-type, forward-curved (FC) fan. The fan shall be equipped with permanently lubricated, anti-friction bearings with an L-50 life of 200,000 hours as calculated per ANSI/AFBMA Standard 9. All fan wheels are dynamically balanced by the fan vendor or unit manufacturer. Fans selected with shaft grounding shall have a maintenance free grounding assembly installed on the fan motor to discharge both static and induced shaft currents to ground.

C. VFD; A Variable Frequency Drive (VFD) shall be provided. A single VFD shall be provide to ensure proper operation and to optimize operating life. Each VFD shall be properly sized, factory mounted, wired to the fan motor, and commissioned to facilitate temporary heating, cooling, ventilation, and/or timely completion of the project. The VFD package shall also include:
1. Electronic manual speed control
2. Inlet fuses to provide maximum protection against inlet short circuit
3. Current limited stall prevention
4. Auto restart after momentary power loss
5. Speed search for starting into rotating motor
6. Anti-windmill w/DC injection before start
7. Phase-to-phase short circuit protection
8. Ground fault protection

D. Fan Shaft Bearings:

1. Self-aligning, pillow-block type with an L-50 rated life of minimum 200,000 hours according to ABMA 9.

E. Internal Vibration Isolation: All fans, including direct drive plenum fans, shall be internally isolated to inhibit noise and vibration through the ductwork and building structure. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

F. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.
2. The motor shall be mounted integral to the isolated fan assembly and furnished by the unit manufacturer. The motor is mounted inside the unit casing on an adjustable base to permit adjustment of drive belt tension (not applicable for direct drive plenum fans). The motor shall meet or exceed all NEMA Standards Publication MG 1 requirements and comply with NEMA Premium efficiency levels when applicable except for fractional horsepower motors which are not covered by the NEMA classification.
3. The motor shall be T-frame, squirrel cage with size, type, and electrical characteristics as shown on the equipment schedule.

2.6 CONTROL

A. Refer to the sequence of operation for the control system and required components.

B. Air handling unit supplier shall coordinate with control contactor to provide all factory installed control components. At minimum the unti shall be provided with the following:

1. Condensate overflow switch
2. Fan status switch
3. Filter status switch
4. Discharge air sensor
5. Mixed air sensor
6. Return air sensor

2.7 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with AHRI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Preheat Coils:

1. Hot-Water Coils: Continuous circuit.

a. Piping Connections: Threaded, same end of coil.
b. Tube Material: Copper.
c. Fin Type: Plate.
d. Fin Material: Aluminum.

e. Fin and Tube Joint: Mechanical bond.
f. Headers:
1) Coils have round seamless copper pipe headers with NPT external thread steel pipe connections. Coils have one vent and one drain connection consisting of 3/8" NPT internal thread copper adapter with steel square head pipe plug.
2) Headers and return bends shall be enclosed by unit.

g. Frames: Channel frame, minimum 0.052-inch thick galvanized steel.
h. Coil Working-Pressure Ratings: 300 psig, 200 deg F.
i. Coating: None.

C. Cooling Coils:

1. Chilled-Water Coil: Continuous circuit.

a. Piping Connections: Threaded, same end of coil.
b. Tube Material: Copper.
c. Tube Thickness: 0.016 inches.
d. Fin Type: Plate.
e. Fin Material: Aluminum.
f. Fin and Tube Joint: Mechanical bond.
g. Headers:
1) Coils have round seamless copper pipe headers with NPT external thread steel pipe connections. Coils have one vent and one drain connection consisting of 3/8" NPT internal thread copper adapter with steel square head pipe plug.
2) Headers and return bends shall be enclosed by unit.

h. Frames: Channel frame, minimum 0.052-inch thick galvanized steel.
i. Coatings: None.
j. Working-Pressure Ratings: 300 psig, 200 deg F.

2.8 AIR FILTRATION SECTION

A. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive.
4. Filter-Media Frame: 2-inch pleated media filters made with 100% synthetic fibers that are continuously laminated to a supported steel-wire grid with water repellent adhesive shall be provided.

B. Side-Access Filter Mounting Frames:

1. Particulate Air Filter Frames: Match inner casing and outer casing material, and insulation thickness. Galvanized steel track.

a. Sealing: Incorporate positive-sealing device to ensure seal between gasketed material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

2.9 SOURCE QUALITY CONTROL

A. AHRI 430 Certification: Air-handling units and their components shall be factory tested according to AHRI 430 and shall be listed and labeled by AHRI.

1. AMCA 210 Compliance: Fan performance according to AMCA 210.

B. AMCA 300 and AMCA 301, or AHRI 260 Certification: Air-handling unit fan sound ratings shall comply with AMCA 300, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data" and AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data," or with AHRI 260, "Sound Rating of Ducted Air Moving and Conditioning Equipment."

C. Water Coils: Factory tested to 300 psig (2070 kPa) according to AHRI 410.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine casing insulation materials and filter media before air-handling unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

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

3.2 INSTALLATION

A. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in other sections.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

D. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to air-handling unit, allow for service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 3/4, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

E. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
7. Comb coil fins for parallel orientation.
8. Verify that proper thermal-overload protection is installed for electric coils.
9. Install new, clean filters.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling unit and air-distribution systems, and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313.13

SECTION 26 00 10 - ELECTRICAL GENERAL PROVISIONS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. General: The provisions of this section are general and are intended to apply to all electrical sections, to govern the quality of design, fabrication, workmanship and operation of materials, equipment and appurtenances to be furnished and/or installed thereunder.

B. Equipment: All electrical equipment, including but not limited to, wiring devices, wiring materials and electrical construction materials shall be new and of the highest quality and latest improved design.

C. Workmanship: Workmanship shall be of the highest grade and all installation work shall be performed by thoroughly qualified mechanics of the appropriate trade. All equipment shall be installed and connected in accordance with the best engineering practice. Manufacturer's instructions and recommendations shall be followed and all electric connections shall be provided.

D. Completeness: The Contractor shall furnish all labor, materials, tools, equipment and services necessary for the complete electrical system ready for continuous operation. Provide all required mounting hardware and accessories to install all equipment and devices. Make all equipment and devices fully operational.

E. Drawings: The drawings showing the layout of the electrical system indicate approximate locations of outlets, apparatus and equipment. The runs of feeders and branches as shown, the drawings are schematic only and are not intended to show the exact routing and location of conduits and conduit terminations. The final determination as to routing, location and termination shall be governed by structural conditions, obstructions and job conditions. This shall not be construed to mean that the design of the system may be changed without the written approval of the Engineer; it merely refers to the exact run of raceways and the exact placement of outlets, etc. It shall be the Contractor's responsibility to obtain all shop drawings affecting conduit terminations to the equipment specified in this or other sections or furnished by others, and to verify conduit locations before installation. The Contractor shall consult all contract drawings and specifications which may affect the location of any outlet, equipment or conduit run, to avoid improper locations of such items and to avoid interference with other trades.

F. Accessibility: Electrical equipment such as junction and pull boxes, panelboards, switches, controls and such other apparatus as may require maintenance or operation from time to time, is made easily accessible. Although the equipment may be shown on the drawings in certain locations, in the course of building construction, it may develop that such locations do not afford proper accessibility, in which case the Contractor shall direct the Engineer's attention to the condition before advancing the construction.

G. Site examinations: All bidders, prior to submitting a bid, shall thoroughly acquaint themselves with the conditions under which the work will be performed. No allowance

shall be made subsequently in connection with this, for any error or negligence on the contractor's part.

H. Unless noted as “existing” or “relocated”, all construction is new and shall be furnished and installed by the contractor.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with electrical construction code requirements of State, City and such other local political subdivision specifications as may exceed the requirements of national codes, standards and approving bodies.

B. All electrical equipment installed under this contract shall bear UL label. Equipment shall be installed in accordance with the requirements of UL and the manufacturer.

C. Comply with the National Electrical Code.

D. Certificates and Permits: Upon completion of work, and prior to final payment, furnish to the Engineer formal certification of final inspections from authorities having jurisdiction and secure required permits or certificates (if any) from such authorities. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction. All the cost for obtaining certificates and permits will be paid by the Contractor.

1.4 REFERENCES AND DEFINITIONS

A. Basic References: The following codes, standards, and approvals as referenced throughout the Sections of Division 26, shall serve as the minimum standards and quality requirements directly appropriate to the work and workmanship. References to catalogs, standards, codes, specifications and recommendations, etc., means latest edition of such publications in effect at the date of invitation to submit bid.

1. American National Standards Institute (ANSI): ANSI C2; National Electrical Safety Code .
2. National Electric Manufacturer's Association (NEMA) Standards as apply to specified Products.
3. National Fire Protection Association (NFPA): NFPA 70 (National Electrical Code), NFPA 72 (National Fire Alarm Code), NFPA 70E (Standard for Electrical Safety Requirements for Employee Workplaces), and other applicable NFPA codes
4. Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals shall govern the quality and performance of specified Products.
5. Americans with Disabilites Act (ADA)
6. Institute of Electrical and Electronics Engineers, Inc (IEEE)
7. National Electrical Contractor's Association (NECA)
8. International Electrical Testing Association (NETA)
9. Occupational Safety and Health Administration (OSHA)

B. Definitions:

1. “Provide” - means “furnish and install”
2. “Indicated” - means “indicated in contract documents”
3. “Concealed” - means items referred to are hidden from normal sight, this includes items partly excavated or crawl spaces and in service tunnels used solely for repairs and maintenance
4. “Exposed” - means items are not “concealed”

5. NETA ATS - International Electrical Testing Association Acceptance Testing Specifications 2007 Edition
6. “Building” - A structure that stands alone or that is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors
7. “degrees C” - means “degrees Celsius”
8. “degrees F” - means “degrees Fahrenheit”

1.5 SUBMITTALS

A. Product Data: Submit Product Data applicable to items listed under Submittals in each Section of Division 26; and such items as may be indicated on the Drawings.

B. Shop Drawings

1. General: The Contractor shall submit to the Engineer for approval, before fabrication, detailed shop drawings for all electrical equipment and materials.
2. Shop drawings shall clearly indicate, using arrows and/or highlighting on all copies, which items are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in these specifications. All pertinent specification and drawing requirements shall be indicated on the manufacturer's drawings. Complete model number of equipment shall be indicated.
3. Shop drawings of related equipment shall be submitted together.

C. "As-Built" Drawings:

1. Accurate project record drawings and specifications, showing in red ink on the working drawings and electrical drawings all changes from the original plans made during installation of the work. Upon completion of the work the contractor shall deliver to the Owner one neat set of drawings with alterations and notations made in red ink.

D. Operating and Maintenance Manuals

1. General: Upon completion of the work, the Contractor shall furnish Operating and Maintenance Manuals for use by the Owner. The manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of catalogs, brochures, bulletins, charts, schedules and drawings describing location, operation, maintenance, lubrication, operating weight and other information necessary for the Owner to establish an effective operating and maintenance program.
2. Shop Drawings: Copies of appropriate shop drawings shall be included in the Operating and Maintenance Manuals. The requirements for manuals is a separate contractual item and in no way supersedes the requirements for shop drawings and vice-versa.
3. Approval: Completed manuals shall be submitted to the Engineer for review and approval. Incomplete or inadequate manuals will be returned to the Contractor for correction and resubmission.
4. Provide 3 copies of each operating and maintenance manual unless a greater quantity is specified elsewhere in the specifications, in which case the higher quantity will apply.
5. Equipment keys and passwords shall be provided to the Owner's authorized representative or representatives. A document shall be provided indicating who received the keys and what are the passwords. Document shall be neat and typewritten.
6. All factory and field test reports shall be included into the O&M Manuals.

7. Provide a separate section in the O&M Manuals for maintenance testing schedules of all equipment. A factory authorized representative of the equipment manufacturer shall certify the maintenance program. Include calendar schedule in table format to indicate all maintenance actions included during the warranty period with spaces for future testing.
8. Records of all factory and field tests by the contractor, manufacturer, or independent testing company shall be included in the O&M Manuals.
9. Wiring diagrams for all factory and field wiring shall be included in the O&M Manuals.

E. Spare Parts and Accessories List

1. A complete list of spare parts and Accessories for equipment shall be provided.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the Project site in a clean condition with openings plugged or capped (or otherwise sealed by packaging) both during shipping and during temporary storage.

B. Delivered electrical equipment crating and/or packaging shall clearly identify pick-points or lift-points. In the absence of crating or packaging, pick-points or lift-points must be identified on the equipment.

C. When unloading materials and equipment provide special lifting harness or apparatus as may be required by manufacturers. Handle materials and equipment in accordance with manufacturer's written instructions.

D. The Contractor shall determine the required equipment needed for unloading operations and have such equipment on site to perform unloading work on the date of equipment delivery.

E. Store materials and equipment, both on and off site, in accordance with manufacturer's written instructions. Keep equipment in a dry location.

1. Temporary Heating: Apply temporary heat to materials and equipment, according to manufacturer's written instructions, throughout periods when environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

1.7 WARRANTY

A. The Contractor shall guarantee that all work performed and all materials and equipment installed by him are free from defects. He shall repair or replace any defective equipment, materials or workmanship, free of cost to the Owner for a period of two (2) years from date of acceptance. Where individual specification sections indicate a Special Warranty period longer than two (2) years, the longer warranty period shall apply.

B. During this warranty period the Contractor shall:

1. Correct and make good all electrical defects. Faulty equipment and materials shall be repaired or replaced as required to produce satisfactory results as directed by the engineer and without additional cost to the Owner. Contractor shall provide service within 24 hours after the call has been made by the Owner.

1.8 DAMAGE TO OTHER WORK

A. Damage: Cutting or damage to existing structures, surfaces or installations shall be repaired at the expense of the Contractor. All such repairs or patching shall be done by mechanics of the appropriate trade and shall be neatly done by mechanics of the appropriate trade and shall be neatly done and in such a fashion as to leave no readily apparent joint or change in appearance, and to leave no structural or other weakness.

1.9 TEMPORARY POWER

A. Contractor shall be entirely responsible for temporary power. All applications, fees, temporary connections, etc. shall be made by the contractor.

1.10 COORDINATION

A. General: The Contractor shall coordinate the work performed and equipment furnished by the Electrical Contractor with work performed and equipment furnished by other trades to ensure a complete and satisfactory installation.

1.11 INTERRUPTION OF ELECTRIC SERVICE

A. Do not interrupt electric, telephone or cable tv service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than 10 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.

1.12 CONTRACTOR'S CERTIFICATION

A. The Contractor shall submit a signed and dated letter to the owner and the engineer certifying the following:

1. He shall certify that all work has been performed in accordance with the contract documents (including, but not limited to: any amendments, addendums, and contract modifications) ;
2. He shall certify that all work has been inspected and approved by the Authorities Having Jurisdiction
3. He shall certify that all work has been performed in accordance with the National Electrical Code and all applicable codes.

END OF SECTION 260010

SECTION 260051 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Touch up paint
6. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: Provide product data for all items indicated in this specification section.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate sleeve selection and application with selection and application of firestopping.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 ACCESS DOORS

A. Door and frame shall be constructed of steel, 16 gauge minimum. Access door shall have a continuous piano hinge. Door shall have a flush mounted lock. Finish shall be prime coat of rust inhibitive electrostatic powder, baked enamel. Access door shall be field painted to match the surrounding wall or ceiling.

B. Provide fire rated access doors to maintain the fire rating of wall and ceiling assemblies, to restore original fire-resistance rating of assembly.

2.5 TOUCH UP PAINT

A. Provide touch up paint from the manufacturer of the electrical equipment. Paint shall match the finish of the equipment. At a minimum, provide touch up paint for the following equipment:

1. Panelboards, electrical cabinets, and enclosures.
2. Electrical switchgear and switchboards.
3. Wireways
4. Surface raceway

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Comply with NFPA 70, National Electrical Code.

C. Measure indicated mounting heights to bottom of unit for suspended items and to bottom of unit for wall-mounting items, unless otherwise noted.

D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

F. Right of Way: Give to piping systems installed at a required slope.

G. Where underground ducts or conduit enter the building, the inside of the ducts or conduit shall be sealed with Duct-Sealing Compound.

H. Where underground ducts or conduit stub up at outdoor transformers, including utility transformers, the inside of the ducts or conduit shall be sealed with Duct-Sealing Compound.

I. Provide touch up paint as required on equipment finishes that have been scratched, and provide touch up paint as directed by the engineer. Touch up paint shall be provided in accordance with the manufacturer's recommendations. Do not allow paint to come in contact with conductors, insulation or any live parts. All nameplates and labels shall remain visible and legible.

J. Overcurrent devices shall be readily accessible and shall be installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 6 feet 7 inches above the floor or working platform.

K. Provide access doors where required to keep concealed electrical devices and equipment accessible in accordance with the National Electrical Code.

L. Unless otherwise noted, access doors shall be painted to match surrounding wall or ceiling.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated ceiling, floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

B. Install UL Listed Firestopping Material in accordance with the manufacturer's recommendations, and UL's requirements.

END OF SECTION 260051

SECTION 260060 - GROUNDING AND BONDING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise noted.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 foot long.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller (exception: conductors for vibrating equipment, such as transformers, motors and generators, shall use stranded conductors), and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.
3. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

END OF SECTION 260060

SECTION 260073 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. RMC: Rigid metal conduit.

B. MFMA: Metal Framing Manufacturer's Association

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. Thomas & Betts Corporation.
   e. Unistrut; Tyco International, Ltd.
   f. Hilti
2. Indoors:
   a. Steel Channel metallic Coatings: Pre-Galvanized Steel with mill galvanized coating designation G90.
   b. Fittings and Accessories:
      (1) Conduit hangers, conduit clamps, beam clamps, and wall brackets shall be pre-galvanized (designation G90) or electroplated zinc (ASTM B633).
      (2) Threaded hardware shall be electroplated zinc (ASTM B633).
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      (1) Cooper B-Line, Inc.; a division of Cooper Industries.
      (2) Empire Tool and Manufacturing Co., Inc.
      (3) Hilti Inc.
      (4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      (5) MKT Fastening, LLC.
2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

E. Provide channel safety end caps, rubber/plastics, for all ends of channels.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260073

SECTION 260075 - ELECTRICAL IDENTIFICATION

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Instrumentation and Control Circuits: Black letters on a yellow field.
3. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

2.4 INSTRUCTION SIGNS

A. Self-Adhesive Instruction Signs: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Phenolic Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number.

C. Locations of Underground Lines: Provide underground-line warning tape for direct buried and concrete encased ducts or ductbanks.

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
2. Where emergency generator is provided, provide a sign at the service disconnect that shows the locations and labels of the disconnects for the generator feeders.
3. For disconnect equipment energized from both sides, a label shall be provided to indicate that all contacts of the disconnect equipment may be energized.

E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 100-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V and 240/120V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

d. Neutral: White

3. Colors for 480/277-V Circuits:
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION 260075

SECTION 260120 - CONDUCTORS AND CABLES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. AWG: American Wire Gauge

B. KCMIL: Thousand Circular Mil

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70, 98% conductivity.

C. Aluminum conductors are not acceptable.

D. Conductor Insulation:

1. Comply with NEMA WC 70 for Types THHN/THWN-2. Suitable for operation at 600 volts or less in wet or dry locations

E. Branch Circuit Type Metal Clad Cable:

1. Conductor Insulation: THHN 90 degree C
2. Copper conductor
3. Neutral wire shall be insulated and shall be the same size as the phase conductors.
4. Voltage Rating: 600V
5. Conductor covering: Polypropylene assembly tape overall
6. Armor: Interlocked steel
7. Fire Wall Rated for 1, 2 and 3 hour rated penetrations
8. Grounding Means: One green insulated copper grounding conductor
9. Suitable for use in environmental air handling spaces
10. UL 1569 Listed

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

1. 600V Vinyl Insulating Tape: The tape is based on polyvinyl chloride (PVC) and/or its copolymers and has a rubber based, pressure-sensitive adhesive. The tape shall be 7 mils thick, and UL Listed and marked per UL Standard 510 as “Flame Retardant, Cold and Weather Resistant.”

C. Screw-on Pressure Cable Connector: Connector shall be UL Listed. Voltage rating shall be 600 volts for building wire and 1000 volts for signs and fixtures.

D. Mechanical Connector: Connector shall be UL Listed. Connector shall be wrapped with electrical insulating tape in accordance with the NEC and the manufacturer's requirements. Connectors shall be dual rated (suitable for use with copper or aluminum conductors), unless otherwise noted.

E. Compression Connector: Connector shall be UL Listed. Connector shall be wrapped with electrical insulating tape in accordance with the NEC and the manufacturer's requirements. Use compression tool recommended by manufacturer. Connectors shall be dual rated (suitable for use with copper or aluminum conductors), unless other wise noted.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller (exception: conductors for vibrating equipment, such as transformers, motors and generators, shall use stranded conductors); stranded for No. 8 AWG and larger.

B. Class 1 and Class 2 Control Wiring: Copper. Stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Aboveground Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

B. Aboveground Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

1. Branch Circuit Type Metal clad cable may be used in lieu of THHN/THWN-2, single conductors in raceway where ALL of the following conditions are met:
   a. Metal clad (MC) cable is fed from circuit breakers or fuses rated at 20 amperes or less;
   b. Metal clad cable is smaller than AWG #8.
   c. Metal clad cable is only used for branch circuit conductors; homeruns from panel to a junction box in accessible concealed ceiling space above or below the first device or switch outlet will be wire installed in EMT or IMC raceway and not Metal clad cables will not be used for homeruns.
   d. Metal clad cable is used only in drywall and above accessible ceilings; in accessible ceiling spaces where MC cable is used, MC cable will be terminated at a junction box or pull box in the ceiling space each room.
   e. Metal clad is only used in lengths no longer than 12 feet, terminating at junction box, outlet box, device or lighting fixture at each end.
   f. Metal clad cable will not pass through to adjacent rooms.
   g. Metal clad cable is used only in aboveground applications;
   h. Metal clad cable is not subject to physical damage;
   i. Metal clad cable is used only in concealed ceilings, walls, and partitions;
   j. Metal clad cable is installed only where allowed by the National Electrical Code, NFPA Codes, and Federal/State/Local Codes.

C. Aboveground Branch Circuits Concealed in partly excavated or crawl spaces and in service tunnels used solely for repairs and maintenance: Type THHN/THWN-2, single conductors in raceway, unless otherwise noted.

D. Aboveground Class 1 and Class 2 Control Wiring: Type THHN/THWN-2, single conductors in raceway unless otherwise noted.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with the NEC.

B. Comply with the manufacturer's recommendations and requirements.

C. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

D. Provide power wiring from the motor starter or control units to each motor. Interlock and control wiring related to the automatic temperature control system will be provided by HVAC contract document.

E. Rough-in and connect to food service, laboratory, and shop equipment furnished under other sections, and equipment furnished by owner.

F. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

H. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

I. Identify and color-code conductors and cables according to Specification Section "Electrical Identification."

J. Do not splice feeders and underground branch circuits unless specifically indicated in the drawings. Cables shall be unspliced between termination points.

K. Provide insulated bushings at the end of each metal clad cable.

L. Use insulating bushings to protect ALL conductors, including conductors smaller than No. 4 AWG. Provide insulated grounding bushings where required by NFPA 70 or the Contract Documents.

M. Spare wires shall be disconnected at both ends and shall be insulated at both ends with wire nuts held in place by electrical insulating tape. For large wire sizes, the spare wires shall be disconnected at both ends and shall be insulated at both ends with double wrapped electrical insulating tape.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION

SECTION 260130 - RACEWAY AND BOXES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. FMC: Flexible metal conduit.

B. LFMC: Liquidtight flexible metal conduit.

C. RNC: Rigid nonmetallic conduit.

D. EMT: Electrical metallic tubing.

1.3 SUBMITTALS

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

B. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. O-Z Gedney; a unit of General Signal.
5. Wheatland Tube Company.
6. Robroy Industries Electrical Products Division

B. Rigid Steel Conduit: ANSI C80.1.

C. FMC: Zinc-coated steel

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Insulating Bushings: Plastic, 105 degree C minimum temperature rating.
2. Insulated Grounding Bushings: Malleable Iron with plastic liner, 105 degree C minimum temperature rating.
3. Conduit Bodies, Couplings and fittings for PVC-Coated Steel Conduit:
   a. PVC coated, with 40 mil PVC exterior coating and 2 mil urethane interior coating

2.2 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type, unless otherwise noted

E. Finish: ANSI 61 gray polyester powder paint finish inside and out over phosphatized surfaces, unless otherwise noted.

2.3 BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Hoffman.
4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
5. O-Z/Gedney; a unit of General Signal.
6. RACO; a Hubbell Company.
7. Robroy Industries, Inc.; Enclosure Division.
8. Spring City Electrical Manufacturing Company.
9. Thomas & Betts Corporation.
10. Walker Systems, Inc.; Wiremold Company (The).

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.4 ENCLOSURES AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hoffman.

B. Hinged-Cover Enclosures: NEMA 250, Type 1, unless otherwise noted, with continuous-hinge cover with flush latch, unless otherwise indicated. Door will have flush, cylinder tumbler-type locks.

C. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below, unless otherwise indicated on the drawings.

1. Aboveground, Exposed: EMT, unless otherwise noted:
2. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise noted.

B. Wireways: All wireways shall be metal, with ANSI 61 gray polyester powder paint finish inside and out over phosphatized surfaces, unless otherwise noted.

C. Minimum Raceway Size: 3/4-inch trade size, unless otherwise noted.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Complete raceway installation before starting conductor installation.

C. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

D. Raceway Terminations: Use insulating bushings to protect ALL conductors, including conductors smaller than No. 4 AWG. Provide insulated grounding bushings where required by NFPA 70 or the Contract Documents.

E. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

F. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where required by NFPA 70 for hazardous (classified) locations.
3. Where otherwise required by NFPA 70.

G. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC where required by the Contract Documents.

H. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

I. Raceway shall run parallel or perpendicular to wall and ceiling structures (columns, joists, support beams, etc.) for a neat appearance.

J. All metallic raceways, boxes and enclosures shall be grounded.

K. Provide watertight hubs for all junction boxes and enclosures installed outdoors or in wet locations. Hubs used with NEMA 3R junction boxes and enclosures shall be NEMA 3R or NEMA 4X rated. Hubs used with NEMA 4 or 4X junction boxes and enclosures shall be NEMA 4X rated.

L. Surface metal raceway:

1. Installation materials and methods shall comply with NEC Article “Surface Metal Raceways”, and the manufacturer’s recommendations.
2. Raceway shall be securely supported in accordance with the National Electrical Code and the manufacturer’s recommendations.
3. Do not exceed the National Electrical Code and the manufacturer’s wire and cable fill capacities.
4. Completeness: Work shall include providing all raceway and appropriate fittings and device plates to install a complete surface raceway system. All unused raceway openings shall be closed.
5. Mechanical Security: All raceways systems shall be mechanically continuous and connected to all electrical outlets, boxes, and cabinets, in accordance with the National Electrical Code and the manufacturer’s recommendations.
6. Electrical Security: All metal raceway shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.
7. Raceway shall run parallel or perpendicular to wall and ceiling structures (columns, joists, support beams, etc.) for a neat appearance.
8. Raceway shall be installed in a neat and professional manner, with no open gaps that allow the enclosed wires and cables to be visible.
9. Do not install surface metal raceways on top of any architectural or educational materials or equipment, including but not limited to: cabinets, whiteboards, blackboards, tack strips, and bulletin boards.
10. Do not install surface metal raceway next to sources of heat such as ranges, ovens and other heating appliances.
11. Do not install surface metal raceway in concealed spaces. Concealed spaces include, but are not limited to, above ceilings and in crawl spaces.
12. Raceway shall be installed in dry locations.
13. Raceway shall be installed aboveground
14. Raceway shall be installed where it is not subject to physical damage.

15. Surface metal raceway shall be installed in accordance with the National Electrical Code, NFPA Codes, and Federal/State/Local Codes.

M. Horizontal runs of raceway shall NOT run above the roof or canopy, unless otherwise noted. The only raceway that is allowed to be visible above the roof or canopy is the vertical raceway from below the roof or canopy to the bottom or side of the roof mounted equipment, unless otherwise noted.

N. Raceway inside the building shall run concealed inside the walls or above ceilings where there is concealed space inside the walls or above the ceilings, unless otherwise noted.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260130

SECTION 260140 - WIRING DEVICES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches.
3. Device wall plates.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. PVC: Polyvinyl chloride.

D. Heavy Duty Grade: Industrial Grade

1.4 SUBMITTALS

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

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wiring Devices:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Mfg. Company Inc.
   c. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498, Tamper-Resistant.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. GFCI Receptacles: Straight blade, feed-through type with feed-through capacity equal to the ampere rating of the receptacle; heavy-duty grade, with ground fault protection, test and reset pushbuttons; NEMA WD 6, duplex receptacle; Complies with UL 498 and UL 943. Design units for installation in a 2-3/4 inch deep outlet box without an adapter.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Stainless steel screws.
2. Material for Switches and Receptacles in Dry Locations: 0.035-inch-thick, satin-finished type 302 stainless steel, unless otherwise noted.

2.5 FINISHES

A. Duplex convenience receptacles: white in color with brass mounting strap.

B. Duplex computer receptacles: gray in color with brass mounted strap.

C. Duplex receptacles on generator power: red in color with brace mounting strap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Apply adhesive film labels on outside of receptacles cover plates identifying circuit designation serving receptacle.

C. Provide a single cover plate where two or more receptacles and/or wiring devices are grouped together in one box.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

E. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Remove wall plates and protect devices and assemblies during painting.

F. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

G. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
5. When conductors larger than No. 10 AWG are installed on 15- or 20-A circuits, splice No. 10 AWG pigtails for device connections.
6. Tighten unused terminal screws on the device.
7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

H. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 CONNECTIONS

A. Ground equipment according to Specification Section "Grounding and Bonding."

B. Connect wiring according to Specification Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 260140

SECTION 260410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosed molded-case circuit breakers.
4. Enclosures.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

E. HVAC: Heating Ventilation and Air Conditioning

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Type HD, Heavy Duty Switch: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Provisions for padlocks: Fusible and non-fusible switches shall include provisions for being padlocked in the open or closed position.

D. Fusible switches shall be suitable for use with Class R fuses unless otherwise noted.

E. Fusible switches shall have clips or bolt pads to accommodate specified fuses.

F. Short circuit rating of Type HD Fusible Switches when used with Class R, Class J, or Class L fuses shall not be less than 200,000A.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

H. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS

A. Available Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Moeller Electric Corporation.
4. Siemens Energy & Automation, Inc.
5. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

C. Provisions for padlocks: Molded-Case Circuit-Breakers shall include provisions for being padlocked in the open or closed position.

1. When the breaker is padlocked in the closed position, the padlock shall not prevent the breaker from tripping due to overcurrent conditions.
2. Enclosed circuit breakers with NEMA 1 Enclosures that are required to be lockable shall have Handle Padlock Attachments.

D. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment;

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
6. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

E. Circuit Breaker Short-Circuit Current Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location. See drawings for NEMA 250 enclosure type.

2.5 IDENTIFICATION

A. Service Equipment Label: Service equipment shall be UL labeled for use as service equipment.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Fusible and Nonfusible Switches shall be Type HD, Heavy Duty Switches, unless otherwise noted.

3.2 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Provide UL Listed fuse reducers as required

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Specification Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure as specified in Specification Section "Electrical Identification."

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 260410

SECTION 260721 - FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fire alarm devices and equipment.

B. The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system (System). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (UL) listings.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

C. UL: Underwriter’s Laboratories

D. LCD: Liquid Crystal Display

E. ADA: Americans with Disabilities Act

F. ADA Rooms: Rooms that are specifically reserved for people with disabilities

G. NAC: Notification Appliance Circuit

H. MC: Metal Clad

1.4 SYSTEM DESCRIPTION

A. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the Engineer for resolution. National standards shall prevail unless local codes are more stringent.

B. System components proposed in this specification shall be UL listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment. The supplier shall be responsible for filing of all documents, paying all fees (including, but not limited to plan checking and permit) and securing all permits, inspections and approvals. Upon receipt of approved drawings from the authority having jurisdiction, the supplier shall immediately forward two sets of drawings to the Owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

C. The equipment and installation shall comply with the current provisions of the following codes and standards:
1. NFPA 70 National Electric Code®
2. NFPA 72 National Fire Alarm Code®
3. NFPA 90A Air Conditioning Systems
4. NFPA 101 Life Safety Code®
5. UL 864 - Control Units for Fire Protective Signaling Systems.
6. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
7. UL 268A - Smoke Detectors for Duct Applications.
8. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
9. UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
10. UL 464 - Audible Signaling Appliances.
11. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.
12. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
13. UL 1971 - Signaling Devices for the Hearing-Impaired.
14. UL 1481 - Power Supplies for Fire Protective Signaling Systems.

1.5 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level III minimum.

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

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for all fire alarm circuits, including, but not limited to, notification appliance circuits. The voltage drop calculations shall show the the maximum allowable distance to the last fire alarm device is not exceeded.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include complete floor plans to indicate equipment and device locations. The address of each addressable device shall be indicated on the floor plans. Show type, size and route of cable and conduits. Floor plans shall be drawn in 1/8” = 1’-0” scale.
8. Include control wiring diagrams showing wire terminations and showing how each device and equipment is to be connected.
9. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.
10. Point-to-point wiring diagrams.
11. Complete description of the sequence of operation.

D. Qualification Data: For qualified Installer.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.
7. Complete documentation of system testing.
8. Certification that the entire system has been inspected and tested, is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and UL listings, and is in proper working order.
9. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Fire Alarm System as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically documented by the system.
10. Provide all drawings in standard .DXF format. A bond paper plot of each sheet shall also be provided.

11. Project specific operating manuals covering the installed Life Safety System. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
12. The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).
13. Provide the name, address and telephone of the authorized factory representative.

G. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

H. UL Certification of Fire Alarm System.

I. A copy of the Fire Alarm System submittal shall be provided to the Permits Department and to the Fire Marshall. Resubmit as required to make clarifications or revisions to obtain approval.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. The fire alarm control panel shall be compatible with MSA’s existing networked fire alarm system. The fire alarm control panel shall be monitored remotely through the existing Simplex network system which is located at another building.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.8 COORDINATION

A. Fire alarm system manufacturer shall coordinate wiring and conduit layout and requirements with the Electrical Contractor.

B. Keys for the locks and switches shall be coordinated with the owner and the Fire Department.

C. Comply with the requirements of the Fire Marshall, the Elevator Safety Inspector and the Authority Having Jurisdiction. Program the fire alarm control panel as required.

1.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
2. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
3. Keys and Tools: One extra set for access to locked and tamperproofed components.
4. Audible and Visual Notification Appliances: One of each type installed.
5. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

B. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

C. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based, system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

D. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Siemens Firefinder

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

   1. Manual stations.
   2. Heat detectors.
   3. Smoke detectors.
   4. Carbon monoxide detector.
   5. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

   1. Continuously operate alarm notification appliances.
   2. Identify alarm at fire-alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Unlock electric door locks in designated egress paths.
   5. Release fire and smoke doors held open by magnetic door holders.
   6. Activate voice/alarm communication system.
   7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
   9. Recall elevators to primary or alternate recall floors.
   10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

   1. Valve supervisory switch.
   2. Elevator shunt-trip supervision.
   3. Duct smoke detectors
   4. Carbon monoxide detection.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

   1. Open circuits, shorts, and grounds in designated circuits.
   2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   3. Ground or a single break in fire-alarm control unit internal circuits.
   4. Abnormal ac voltage at fire-alarm control unit.
   5. Break in standby battery circuitry.
   6. Failure of battery charging.
   7. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Trouble and Supervisory Signal Actions: Annunciate at fire-alarm control unit and remote annunciators. Transmit trouble or supervisory signal to the remote alarm receiving station.

2.3 BOOSTER POWER SUPPLIES

A. The booster supply must incorporate four independent supervised Notification Appliance Circuits. It shall be possible to configure the NACs to follow the main panel's NAC or activate from intelligent Signature Series modules. The booster NACs must be configurable to operate independently at any one of the following rates: continuous; 120 SPM; or, 3-3-3 temporal. Fault conditions on the booster shall not impede alarm activation of host NAC circuits.

B. Fault conditions detected by the power supply shall open the main fire alarm control panel's NAC. This initiates a trouble condition and eliminates the need to wire a separate trouble signal back to the control panel.

C. Power supply shall have an enclosure.

D. Battery backup shall be provided.

2.4 MANUAL FIRE-ALARM BOXES

A. Provide analog/addressable single action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of metal construction and incorporate an internal toggle switch. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers.

B. Provide addressable single action, single stage fire alarm stations.

2.5 SYSTEM SMOKE DETECTORS

A. Analog Addressable Smoke General
   1. Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive.
   2. An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event.
   3. The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 80% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% compensation has been used.
   4. The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

B. Smoke Detector – Photoelectric
   1. Smoke detector shall be analog/addressable photoelectric smoke detector type.

2. The system shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting alarm signals as well as normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value.

C. Duct Detector Housing
1. Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel.
2. A remote key-operated test station with built-in alarm LED indicator shall be provided for each duct smoke detector.

2.6 SYSTEM HEAT DETECTORS

A. Heat detector shall be analog/addressable combination fixed temperature / rate-of-rise detector type.

B. The heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate of rise alarm point of 15°F(9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

C. Provide analog/addressable combination fixed temperature / rate-of-rise detector.

2.7 DETECTOR BASES

A. Provide standard detector mounting bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box. The base shall, contain no electronics and support all series detector types.

2.8 NOTIFICATION APPLIANCES

A. General (signals)
1. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessabilities Guidelines (ADA(AG)), and shall be UL 1971 Listed.
2. All notification appliances shall be red unless noted otherwise on the drawings.
3. The word “FIRE” shall be engraved on the devices.
4. Provide weatherproof devices where indicated on the drawings.
5. Weatherproof devices shall be suitable for use in -35 degrees Fahrenheit temperature.

B. Horns

1. The horn shall have a minimum of 3 switch selectable settings for dBA levels. Horn shall be UL Listed under Standard 464.

C. Strobes
1. Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 15/75cd, 30cd, 75cd and 110cd. Candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring.

D. Horn-Strobe
1. The combination device shall consist of a horn and a strobe.
   a. The horn shall have a minimum of 3 switch selectable settings for dBA levels. Horn shall be UL Listed under Standard 464.
   b. Strobes shall provide synchronized flash output, that shall be switch selectable for output values of 15cd, 15/75cd, 30cd, 75cd and 110cd. Candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring.

2.9 INITIATION AND CONTROL MODULES

A. Intelligent Modules – General
1. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing

B. Control Relay Module
1. The Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc (0.5 amps at 120VAC) to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

C. Dual Input Module
1. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The dual input module shall support the following circuit types:
   a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
   c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
   d. Normally-Open Active Latching (Supervisory, Tamper Switches

D. Isolator Module
1. The Isolator Module shall be capable of isolating and removing a fault from a class A data circuit while allowing the remaining data loop to continue operating. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.

E. Single Input Module
1. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers. The single input module shall support the following circuit types:
a. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
b. Normally-Open Alarm Delayed Latching (Waterflow Switches)
c. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
d. Normally-Open Active Latching (Supervisory, Tamper Switches)

F. Single Input Signal Module
1. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The single input signal module shall support the following operations:
a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)

G. Dual Input Signal Module
1. The Dual Input (Dual Riser Select) Signal Module shall provide two (2) supervised Class B output circuits capable of a minimum of 2 personalities, each with a distinct operation. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone". The module shall be suitable for mounting on North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes. The dual input signal module shall support the following operations:
a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)

H. Multi-Voltage Control Relay
1. The relay is encapsulated multi-voltage device providing 10 amp form C contacts. The relay may be energized by one of three input voltages: 24VAC, 24VDC or 115VAC.
2. The relay shall support the following operations:
a. To be provided as required to switch larger currents that cannot be handled by other devices.
b. To monitor 24VDC voltage.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Provide booster power supplies as required or as indicated. Field install circuit breakers as required to provide power to the power supplies. Provide branch circuit wiring (2#12 & #12G in 1/2" conduit, minimum) to feed power to the power supply. Install power supplies in an accessible location that is fully sprinkled. If the location is not fully sprinkled, provide an addressable smoke detector above the power supply. Do not install power supply above the ceiling.

B. Fire Alarm System shall be UL Certified. Cost for UL Certification shall be paid for by the Contractor.

C. If the booster or audio power supplies are located in unsprinklered spaces, provide smoke detectors above the power supplies whether or not the smoke detectors are shown on the plan drawings.

D. Comply with NFPA 72 for installation of fire-alarm equipment.

E. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

F. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

H. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Comply with NFPA 72.

I. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

J. Circuit disconnecting means (circuit breaker) for the Fire Alarm Control Panel shall have a red marking, and shall be identified as "FIRE ALARM CIRCUIT".

K. Circuit disconnecting means (circuit breaker) for the Fire Alarm power supplies and other fire alarm system components that require 120VAC shall have a red marking, and shall be identified as "FIRE ALARM - XXX", where "XXX" is the description of the equipment.

L. The location of the circuit disconnecting means (circuit breaker) feeding the Fire Alarm Control Panel shall be permanently identified at the Fire Alarm Control Panel.

M. All strobes shall flash in synchronization. Provide synchronization modules as required.

N. Install horns and strobes such that the horns can be silenced without affecting the strobes.

O. Alarm silence shall only be possible through key operation by authorized personnel. The alarm silence feature may be inhibited through programming. Coordinate with the Fire Marshall for program requirements.

3.2 CONNECTIONS

A. Install the interface device less than 3 feet from the device controlled unless otherwise noted. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Specification Section "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

C. Identify each cable segment between devices with a unique number corresponding to the address of the device.

D. Junction box covers shall be painted red.

E. Fire alarms cables shall be red in color.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by Architect and authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
7. Using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4, field verify that the measured sound level (during a fire alarm condition) in each room, space or area complies ADA and NFPA 72 requirements. Record the measured sound level in each room, space or area, and indicate if it complies with ADA and NFPA 72 requirements. If it does not comply, provide written recommendations in order to fix the deficiency.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.

C. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

D. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

E. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

END OF SECTION 260721

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79 and IES LM-80.

    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting luminaires.
2. Suspended ceiling components.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of luminaire.

E. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. At least 10 percent spare luminaires shall be provided.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

3. Globes and Guards: two for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURES:

A. Product: Subject to compliance with requirements, provide product indicated on drawings.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Luminaires have LED modules and associated drivers. LED modules and associated drivers shall be fully compatible with control devices and room lighting control units.

F. Luminaires shall have 0-10-volt linear dimming LED diming.

G. Luminaires shall be 100 percent fully compatible with sensors and relays which are controlling the luminaires.

H. Bulb shape complying with ANSI C79.1.

I. Lamp base complying with ANSI C81.61 or IEC 60061-1.

J. CRI of minimum 80. CCT of 4100 K, unless otherwise noted on drawings.

K. Rated lamp life of 50,000 hours.

L. Lamps dimmable from 100 percent to 0 percent of maximum light output.

M. Internal driver.

N. Nominal Operating Voltage: multi-voltage 120/277 V ac.

1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

O. Housings:

1. Extruded-aluminum housing and heat sink.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage, and coating.
   c. CCT and CRI for all luminaires.

2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire. At the salt barn, use PVC coated steel tubing.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 1/4-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with four-point pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Do not use ceiling grid as support for luminaires. Connect support wires to building structure.
4. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
5. Install at least four independent support wires from building structure to tabs on the lighting fixture. Locate not more than 6 inches from lighting fixture corners. Wire shall have breaking strength of the weight of fixture at a safety factor of 4. Wires shall be arranged to support the fixture directly from the building structure.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119