PROJECT MANUAL

for

Jackson County Airport – Terminal Building

Jefferson, Georgia

January 29th, 2024

CONSTRUCTION DOCUMENTATION SET

Prepared By

Goodwyn, Mills And Cawood, LLC.
6120 Powers Ferry Road, NW
Suite 350
Atlanta, GA 30339
T 770.952.2481
www.gmcnetwork.com

GMC PROJECT NUMBER: AATL230012

PROJECT MANUAL
TABLE OF CONTENTS

DIVISION 13 – SPECIAL CONSTRUCTION:

NOT USED

DIVISION 14 – CONVEYING EQUIPMENT:

NOT USED

DIVISION 21 -FIRE SUPPRESSION:

NOT USED

DIVISION 22 - PLUMBING:

DIVISION 23 -HEATING, VENTILATING, AND AIR CONDITIONING:

DIVISION 26 -ELECTRICAL:

END OF TABLE OF CONTENTS

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 10 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

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

B. Substitutions for Convenience: Not allowed unless otherwise indicated

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General coordination procedures.
2. Coordination drawings.
3. Request for Information (RFI).
4. Digital project management procedures.
5. Project meetings.

1.3 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, telephone number, and email address 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.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.
1. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses.
2. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
3. Post copies of list in project meeting room, in temporary field office and in prominent location in built facility. Keep list current at all times.

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.
1. Include such items as required notices, reports, and list of attendees at meetings.
2. 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, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

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

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

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of

visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
    a. DWG Version AutoCAD20, operating in Microsoft Windows operating system.

7. File Submittal Format: Submit or post coordination drawing files using PDF format
8. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in AutoCAD format
    c. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual

1.6 REQUEST FOR INFORMATION (RFI):

A. RFI Procedure: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
    1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
    2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
    1. Project name.
    2. Project number.
    3. Date.
    4. Name of Contractor.
    5. Name of Architect.
    6. RFI number, numbered sequentially.
    7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Use AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to the General Conditions of the Contract. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following information in the log:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

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 and Architect of scheduled meeting dates and times a minimum of ten (10) working days prior to meeting.
   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, and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Responsibilities and personnel assignments, including designation of key personnel and their duties.
      b. Tentative construction schedule.
      c. Phasing.
      d. Critical work sequencing and long lead items.
      e. Lines of communications.
      f. Procedures for processing field decisions and Change Orders.
      g. Procedures for RFIs.
      h. Procedures for testing and inspecting.
      i. Procedures for processing Applications for Payment.
      j. Distribution of the Contract Documents.
      k. Submittal procedures.
      l. Preparation of Record Documents.
      m. Use of the premises.
      n. Work restrictions.
      o. Working hours.
      p. Owner's occupancy requirements.
      q. Responsibility for temporary facilities and controls.
      r. Procedures for moisture and mold control.
      s. Procedures for disruptions and shutdowns.
      t. Construction waste management and recycling.
      u. Parking availability.
      v. Office, work, and storage areas.
      w. Equipment deliveries and priorities.
      x. First aid.
      y. Security.
      z. 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 when required by other sections and when required for coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect 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 requirements.
      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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than ninety (90) days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned

parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of Record Documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Procedures for completing and archiving web-based Project software site data files.
   d. Submittal of written warranties.
   e. Requirements for preparing operations and maintenance data.
   f. Requirements for delivery of material samples, attic stock, and spare parts.
   g. Requirements for demonstration and training.
   h. Preparation of Contractor's punch list.
   i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   j. Submittal procedures.
   k. Owner's partial occupancy requirements.
   l. Installation of Owner's furniture, fixtures, and equipment.
   m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at monthly intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: Representatives of Owner and Architect, 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.
   3. 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.
         1) Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.
         2) Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         3) 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 use.
         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.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
5. 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

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

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

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
3. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's final release or approval.
   g. Scheduled date of fabrication.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
5. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittal Identification: 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 Architect.
3. Include the following information for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Name of subcontractor.
   f. Name of supplier.
   g. Name of manufacturer.
   h. Submittal number or other unique identifier, including revision identifier.
   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Location(s) where product is to be installed, as appropriate.
   l. Other necessary identification.
4. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract

Documents, initial submittal may serve as final submittal. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
   a. Transmittal Form: Use AIA Document G810 or CSI Form 12.1A.
   b. Indicate the following on transmittal:
      1) Project name.
      2) Date.
      3) Destination (To:).
      4) Source (From:).
      5) Name and address of Architect.
      6) Name of Contractor.
      7) Name of firm or entity that prepared submittal.
      8) Names of subcontractor, manufacturer, and supplier.
      9) Category and type of submittal.
      10) Submittal purpose and description.
      11) Specification Section number and title.
      12) Specification paragraph number or drawing designation and generic name for each of multiple items.
      13) Drawing number and detail references, as appropriate.
      14) Indication of full or partial submittal.
      15) Transmittal number, numbered consecutively.
      16) Submittal and transmittal distribution record.
      17) Remarks.
      18) Signature of transmitter.

C. 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.
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
   4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name of Contractor.
      e. Name of firm or entity that prepared submittal.
      f. Names of subcontractor, manufacturer, and supplier.
      g. Category and type of submittal.
      h. Submittal purpose and description.
      i. Specification Section number and title.
      j. Specification paragraph number or drawing designation and generic name for each of multiple items.

k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number, numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. 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.

D. Options: Identify options requiring selection by Architect.

E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

F. 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.

G. 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.

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals via email as PDF electronic files.
   a. Architect will return annotated file.
   b. Annotate and retain one copy of file as an electronic Project record document file.
2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and

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

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

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

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. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Templates and patterns.
   g. Compliance with specified standards.
   h. Notation of coordination requirements.
   i. Notation of dimensions established by field measurement.
   j. Relationship and attachment to adjoining construction clearly indicated.
   k. 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 40 inches.

3. Submittal Method: Submit Shop Drawings PDF electronic file format.

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.
      e. Specification paragraph number and generic name of each item.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line.
      b. Architect will return submittal with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected.
      a. Samples include, but are not limited to 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.
      b. Number of Samples: Submit three (3) sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
         2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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.
   1. Include the following information in tabular form:
      a. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
      b. Manufacturer and product name, and model number if applicable.
      c. Number and name of room or space.
      d. Location within room or space.
   2. Submittal Method: Submit product schedule in PDF electronic file format.

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Project Closeout."

H. Maintenance Data: Comply with requirements specified in Division 1 Section "Project Closeout."

I. 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.

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

K. 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.

L. 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.

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

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

O. 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.

P. 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.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. 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.

S. 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.

T. 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.

U. 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.
1. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable.
2. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents.
2. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

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

3.2 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
1. "NO EXCEPTIONS TAKEN" indicates that fabrication may begin on all items.
2. "REJECTED" indicates that the submission is unacceptable and requires resubmission. In the case of mock-up, reconstruction will be required. Contractor shall make corrections as noted and resubmit. Fabrication shall not begin on items covered by shop drawings bearing this notation.
3. "MAKE CORRECTIONS NOTED" indicates that Contractor shall make the corrections indicated on the returned submittal. This notation will permit fabrication to begin on all items subject to the corrections indicated.
4. “AMEND AND RESUBMIT” indicates that contractor shall delay fabrication on items affected by the corrections, make appropriate changes and resubmit.
5. "SUBMIT SPECIFIED ITEM" indicates that the item submitted is not specified and unacceptable. Submittal will be returned without review. Only the item specified is to be submitted for review.

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

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances.
1. Mockups are not Samples.
2. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

C. Special Inspection and Testing Agency Reports: The special inspector's reports and testing agency's results shall have precedence over reports and test results provided by the Contractor.

1.5 SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.7 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations.
1. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

2. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an A2LA independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
3. A2LA: A testing agency accredited by the American Association for Laboratory Accreditation.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   e. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction. Allow seven (7) days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and

conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination:
1. Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
2. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes.
2. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
3. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECION 014000

SECTION 014150 – SPECIAL INSPECTIONS

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. Description:

1. This Section includes the procedural requirements for quality assurance for Special Inspections.
2. Special inspection and testing services are required to provide a detailed verification of compliance with the Construction Documents, codes and standards specified. Special Inspection services and the presence of Special Inspectors on site do not relieve the Contractor of responsibility for compliance with the Construction Document requirements.
3. The Registered Design Professional for special inspections is typically the Architect or Structural Engineer. Often the Architect will take input from the Structural, Mechanical and Electrical Engineers and act as the overall Registered Design Professional in Responsible Charge of preparing and submitting the Statement of Special Inspections.

B. Related Documents and Standards:

1. All Special Inspections on this project shall conform to the Construction Documents and the applicable building code including referenced standards, in addition to this document. The Special Inspections Package has been submitted as part of the Construction Documents. These documents describe Contractor responsibilities, Fabricator responsibilities, required inspections/testing and inspections/testing frequency.
2. Hold a Special Inspections preconstruction meeting at least 7 days prior to initial planned date for start of work requiring Special Inspections.

    a. Discussions shall include the following:

        1) Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
        2) Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional:

    b. Notification and reporting procedures:

3. Attendees shall include Contractor, Owner’s Representative, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and Architecture

C. Related Sections:

1. Division 03 Specifications – Concrete Construction.
2. Division 05 Specifications – Steel Construction.

1.3 QUALITY CONTROL

A. Special Inspections shall be performed by agents who have relevant experience for each category of inspections. Minimum qualifications and certifications for each category are indicated in the building code.

B. Special Inspections and Testing: Owner will engage an agency to conduct Special Inspections and Testing as described in the referenced Special Inspections documentation and as required by authorities having jurisdiction.

1. Special Inspector and his agents will notify Registered Design Professional and Contractor of deficiencies observed in the Work.
2. Special Inspector and his agents will submit a certified written report of each test, inspection and similar quality-control service.
3. Special Inspector and his agents will submit a Final Report of Special Inspections at the completion of the Special Inspections stating work was completed in substantial conformance with Construction Documents. Final Report of Special Inspections shall state required inspections have been performed and itemize nonconforming work not corrected or resolved as coordinated with the Design Professional in Responsible Charge. Final Report of Special Inspections is included with the Statements of Special Inspections for use by the Special Inspector(s) and his agents.
4. Special Inspector and his agents will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Construction Documents.
5. Special Inspector and his agents will retest and reinspect corrected work.
6. Owner’s selection of a Special Inspector in no way relieves the Contractor of responsibility to perform work in full compliance with Construction Documents.

1.4 SUBMITTALS

A. Special Inspector and Agency Qualification Data: Inspection agencies shall submit a copy of their qualifications, including names and qualifications of each inspector and technician who will be performing inspections or tests, to the Code Enforcement Official. Special Inspector and Agency shall be acceptable to the Code Enforcement Official.

B. Reports: Special Inspectors shall submit inspection reports of each test or inspection to the Contractor, Architect of Record, Structural Engineer of Record, Design Professional in Responsible Charge, and the Owner. Reports to be submitted on forms approved by the Design Professional in Responsible Charge. All deficiencies shall be highlighted in reports and presence of deficiencies shall be noted within the report title.

C. Permits, Licenses, and Certificates: For Owner’s records, submit copies of certifications, inspection reports, releases, deficiencies, Architect/Engineer sketches regarding deficiencies, correspondence, records, and similar documents established for compliance with the Special Inspections program documented by the Special Inspection Statement and Schedule.

D. Owner shall provide all completed Special Inspection forms and schedule of Special Inspections to Special Inspector(s) with all Construction Documents and document changes.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SPECIAL INSPECTION FORMS

A. Statements of Special Inspections: The attached Statements of Special Inspections, completed by the registered Design Professional in Responsible Charge, shall be submitted to the Building Official at the time of permit application. Copies of the forms, approved by the Building Official, shall be kept by the Contractor at a central location on the project site and submitted to the Design Professional in Responsible Charge.

B. Schedule of Special Inspections: The Schedule of Special Inspections shall be submitted to the Building Official at the time of permit application. Special Inspectors shall initial and date each item in the "Completed" column when the inspections for the specific scope of work are completed. A copy of the Schedule of Special Inspections containing signatures for all tasks requiring inspection shall be submitted to the Design Professional in Responsible Charge with the Final Reports of Special Inspections.

C. Contractor's Statement of Responsibility: Contractor shall review the Statements of Special Inspections and Schedule of Special Inspections. Contractor shall complete the Contractor Statement of Responsibility and submit the statement to the Design Professional in Responsible Charge.

D. Fabricator's Certificate of Compliance: Contractor shall forward one copy of Fabricator's Certificate of Compliance to each Fabricator who provides fabrication materials noted for Special Inspection in the schedule and who is exempt from Special Inspection per the following:

E. Fabricator's Certificate of Compliance: Contractor shall forward one copy of Fabricator's Certificate of Compliance to each Fabricator who provides fabrication materials noted for Special Inspection in the schedule and who is exempt from Special Inspection per Section 1704.2.5.2 of the Building Code. Contractor shall submit all Certificates to the Design Professional in Responsible Charge.

F. Final Report of Special Inspections: The Final Report of Special Inspections (blank report is submitted with the Statements of Special Inspections and Schedule, for reference) shall be submitted to the Building Official when all Special Inspection requirements for the project are completed and there are no outstanding deficiencies in work scheduled for inspections/testing. Each Special Inspection agency noted in the Schedule is required to submit a copy of this form for their scope of work.

3.2 OWNER RESPONSIBILTIES

A. Owner will engage and pay for services of Special Inspector and his agents.

B. Owner will engage either the Architect or one of his consultants to act as the Design Professional in Responsible Charge and pay for services of administrating this program.

C. The Design Professional will engage the services of the Special Inspector and his agents on behalf of GSFIC.

3.3 CONTRACTOR RESPONSIBILITIES

A. Contractor to whom building permit is issued shall have and maintain responsibility to manage, direct, and control construction activities on Project for which building permit is issued.

B. Contractor shall designate a representative who shall be the direct point-of-contact with the Special Inspector(s) during each phase of work. Designated representative will work with the Special Inspector(s) and Design Professional in Responsible Charge to communicate and coordinate for corrective actions required for discrepancies noted during work progress.

C. Contractor shall review the Schedule of Special Inspections to become familiar with all of the required testing and inspections and shall cooperate with Special inspector(s) to provide access to construction activities and manufacturer's operations that are to be tested/inspected.

D. Provide required copies of product test reports to Special Inspector(s).

E. Secure and deliver to Special Inspector(s) adequate quantities of representative material samples that require testing/inspection as part of the Schedule of Special Inspections.

F. Provide incidental labor and facilities:

1. To facilitate tests and inspections that are required by Special Inspections and noted in the Schedule of Special Inspections.
2. To provide access to construction activities to be tested.
3. To obtain and handle samples at Project site or at source of product to be tested.
4. For storage and curing of test samples.

G. Notify Special lnspector(s) and his agents at least 48 hours in advance of required inspection or test:

1. When tests or inspections cannot be performed after such notice, immediately notify Special Inspector to discuss alterations of work and subsequent inspection(s) to allow for required testing/inspection by Special Inspector(s).
2. If the Special Inspector is not notified in time to cancel and reschedule any required inspection, the Contractor shall reimburse Owner through Change Order procedure for Special lnspector(s) personnel and travel expenses incurred. Contractor, Special Inspector, and Owner shall develop procedures and associated costs for the Change Order procedure noted.

H. Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Construction Document requirements, regardless of whether original test was Contractor's responsibility.

I. Cost of construction related to retesting, deficiencies, corrective work, revised or replaced by Contractor, is Contractor's responsibility where required tests performed on original construction indicated noncompliance with Construction Document requirements.

J. Contractor shall be solely responsible for construction site safety.

3.4 SPECIAL INSPECTOR(S) RESPONSIBILITES

A. Review all Special Inspection statements and the Schedule of Special Inspections and become familiar with the structural design for the project and construction requirements, such that the Inspector(s) and his agents may provide adequate verification observations to assure conformance with Construction Documents.

B. Review Construction Documents and reference documents cited in sufficient detail that he may assure himself that conformance is provided.

C. Contact local Enforcement Agency/Building Official and Design Professional in Responsible Charge to determine requirements for testing/inspection report and nonconformance log formatting and frequency. Determine if all reporting will be transmitted to the Design Professional in Responsible Charge or if any of the reporting must also be transmitted directly from the Special Inspector(s) to the local Enforcement Agency/Building Official.

D. Consult with the Design Professional in Responsible Charge for clarification regarding questions from the site, deficiencies, and misinterpretations of the work.

E. Attend preconstruction meetings and routine job conferences called by Contractor.

F. Provide on-site testing, inspections, and observations of phases of work in accordance with frequencies noted for each type of inspection in the Schedule of Special Inspections and to assure himself Contractor is performing work in accord with Construction Documents.

G. Receive and review required Contractor submittals for verification of conformance to Construction Documents.

H. Provide local Enforcement Agency/Building Official and Design Professional in Responsible Charge with periodic Special Inspection reports, all testing/inspection documentation, and reports of outstanding/resolved nonconformances with report formats and report frequencies coordinated at the start of the Special Inspections program.

3.5 LIMITS ON AUTHORITY

A. Special Inspector and his agents shall not release, revoke, alter, or enlarge on requirements of Construction Documents.

B. Special Inspector and his agents shall not have control over Contractor’s means and methods of construction.

C. Special Inspector and his agents shall not have authority to stop work.

3.6 COMMUNICATION

A. Testing Agency shall immediately notify Contractor and Registered Design Professional by e-mail of test results or inspections failing to comply with requirements of the Construction Documents.

B. Special Inspector shall immediately notify Contractor of work found to be in nonconformance with the Construction Documents. If nonconforming work is not corrected while the Special Inspector is on-site, Special Inspector shall notify Registered Design Professional within 24 hours (one business day) and issue a nonconformance report.

C. If nonconforming work is not corrected at time of substantial completion of structure or other appropriate time, Special Inspector shall notify Code Enforcement Official.

D. Special Inspector and his agents submit reports within 7 days of inspection or test.

E. Special Inspector and his agents shall leave report with the General Contractor and GSFIC prior to leaving the site each day. The final reviewed, typed report shall be submitted within 7 days of inspection or test.

3.7 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by, or for, quality control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014150

STATEMENT OF SPECIAL INSPECTIONS

PROJECT: JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT

LOCATION: 500 SKY HARBOR WAY, JEFFERSON, GA

PERMIT APPLICANT: KEVIN C. POE, COUNTY MANAGER.

APPLICANT'S ADDRESS: 67 ATHENS STREET, JEFFERSON, GA 30549

ARCHITECT OF RECORD: AMY BELL, ARCHITECT.

STRUCTURAL ENGINEER OF RECORD: MICHAEL B. PLANER, S.E.

MECHANICAL ENGINEER OF RECORD: GREGG COX, M.E.

ELECTRICAL ENGINEER OF RECORD: TIM SMITHERMAN, E.E.

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: MATTHEW NICHOLSON, ARCHITECT.

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2018 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Seismic Resistance* and/or *Special Inspections for Wind Resistance*.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*?	☒ Yes	☐ No
Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*?	☐ Yes	☒ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

__Weekly __Bi-Weekly __Monthly Other; specify: As required by the Bldg Official

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

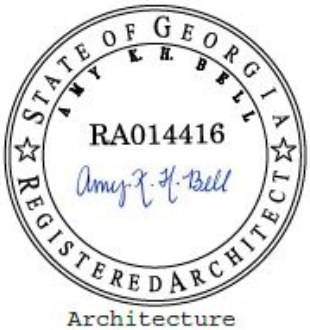
Amy K.H.Bell

Type or print name

Amy K. H. Bell 1/22/2024

Signature Date

Preparer's Seal



Building Official's Acceptance:

Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

__Monthly __Bi- Monthly __Upon Completion Other; specify: As required by the Bldg Official

Special Inspections for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Seismic Design Category: C

Special Inspections for Seismic Resistance Required (Yes/No): YES

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:
(Where required per IBC Sections 1705.12.1, 1705.12.2, and 1705.12.3) (Special inspections for seismic resistance of structural steel, where required, shall be in accordance with AISC 341)

Description of designated seismic systems subject to special inspection and testing for seismic resistance:
(Required for architectural, electrical and mechanical systems and their components that require design in accordance with Chapter 13 of ASCE 7, have a component importance factor, *Ip*, greater than one and are in Seismic Design Categories C, D, E or F.)

Description of additional seismic systems and components requiring special inspections:
(Required for systems noted in IBC Section 1705.12.5, 1705.12.6, 1705.12.7, and 1705.12.8.)

Description of additional seismic systems and components requiring testing:
(Where required per IBC Section 1705.13)

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

Special Inspections for Wind Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Allowable Stress Design Wind Speed, V_{asd}: 83 m.p.h.

Wind Exposure Category: C

Special Inspection for Wind Resistance Required (Yes/No): NO
(Required in wind exposure Category B, where the allowable stress design wind speed, V_{asd}, is 120 miles per hour or greater. Required in wind exposure Category C or D, where the allowable stress design wind speed, V_{asd}, is 110 miles per hour or greater).)

Description of structural wood and cold-formed steel light frame construction main windforce-resisting system subject to special inspections for wind resistance:
(Required for systems noted in IBC Section 1705.11.1 and 1705.11.2).

Description of windforce-resisting components subject to special inspections for wind resistance:
(Required for systems and components noted in IBC Section 1705.11.3)

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements)	Submittal review, shop[3] and/or field inspection				
1705.2.1 Structural Steel Construction					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, Section N 3.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of structural steel	Shop[3] and field inspection	Y	Periodic		
3. Structural steel welding: Inspection tasks prior to welding.					
a. Verify welder qualification records and continuity records.	Shop[3] and field inspection	Y	Observe[4]		
b. Verify welding procedure specifications (WPSs) available.	Shop[3] and field inspection	Y	Perform[4]		
c. Verify manufacturer certifications for welding consumables available.	Shop[3] and field inspection	Y	Perform[4]		
d. Verify material identification (type/grade).	Shop[3] and field inspection	Y	Observe[4]		
e. Verify welder identification system (The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type).	Shop[3] and field inspection	Y	Observe[4]		
f. Verify fit-up of groove welds (including joint geometry):					
i. Joint preparations	Shop[3] and field inspection	Y	Observe[4]		
ii. Dimensions (alignment, root opening, root face, bevel)	Shop[3] and field inspection	Y	Observe[4]		
iii. Cleanliness (condition of steel surfaces)	Shop[3] and field inspection	Y	Observe[4]		
iv. Tacking (tack weld quality and location)	Shop[3] and field inspection	Y	Observe[4]		
v. Backing type and fit (if applicable)	Shop[3] and field inspection	Y	Observe[4]		
g. Verify fit-up of CJP groove welds of HSS T-, Y- and K-joints without backing (including joint geometry):					
i. Joint preparations	Shop[3] and field inspection	Y	Observe[4]		
ii. Dimensions (alignment, root opening, root face, bevel)	Shop[3] and field inspection	Y	Observe[4]		
iii. Cleanliness (condition of steel surfaces)	Shop[3] and field inspection	Y	Observe[4]		
iv. Tacking (tack weld quality and location)	Shop[3] and field inspection	Y	Observe[4]		
h. Verify configuration and finish of access holes.	Shop[3] and field inspection	Y	Observe[4]		
i. Verify fit-up of fillet welds:					
i. Dimensions (alignment, gaps at root)	Shop[3] and field inspection	Y	Observe[4]		
ii. Cleanliness (condition of steel surfaces)	Shop[3] and field inspection	Y	Observe[4]		
iii. Tacking (tack weld quality and location)	Shop[3] and field inspection	Y	Observe[4]		
4. Structural steel welding: Inspection tasks during welding.					
a. Verify control and handling of welding consumables:					
i. Packaging	Shop[3] and field inspection	Y	Observe[4]		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
ii. Exposure control	Shop[3] and field inspection	Y	Observe[4]		
b. Verify no welding over cracked tack welds.	Shop[3] and field inspection	Y	Observe[4]		
c. Verify environmental conditions:					
i. Wind speed within limits	Shop[3] and field inspection	Y	Observe[4]		
ii. Precipitation and temperature	Shop[3] and field inspection	Y	Observe[4]		
d. Verify WPS followed:					
i. Settings on welding equipment	Shop[3] and field inspection	Y	Observe[4]		
ii. Travel speed	Shop[3] and field inspection	Y	Observe[4]		
iii. Selected welding materials	Shop[3] and field inspection	Y	Observe[4]		
iv. Shielding gas type/flow rate	Shop[3] and field inspection	Y	Observe[4]		
v. Preheat applied	Shop[3] and field inspection	Y	Observe[4]		
vi. Interpass temperature maintained (min./max.)	Shop[3] and field inspection	Y	Observe[4]		
vii. Proper positon (F, V, H, OH)	Shop[3] and field inspection	Y	Observe[4]		
e. Verify welding techniques:					
i. Interpass and final cleaning	Shop[3] and field inspection	Y	Observe[4]		
ii. Each pass within profile limitations	Shop[3] and field inspection	Y	Observe[4]		
iii. Each pass meets quality requirements	Shop[3] and field inspection	Y	Observe[4]		
f. Verify placement and installation of steel headed stud anchors	Shop[3] and field inspection	Y	Perform[4]		
5. Structural steel welding: Inspection tasks after welding.					
a. Verify welds cleaned	Shop[3] and field inspection	Y	Observe[4]		
b. Verify size, length and location of welds	Shop[3] and field inspection	Y	Perform[4]		
c. Verify welds meet visual acceptance criteria:					
i. Crack prohibition	Shop[3] and field inspection	Y	Perform[4]		
ii. Weld/base-metal fusion	Shop[3] and field inspection	Y	Perform[4]		
iii. Crater cross section	Shop[3] and field inspection	Y	Perform[4]		
iv. Weld profiles	Shop[3] and field inspection	Y	Perform[4]		
v. Weld size	Shop[3] and field inspection	Y	Perform[4]		
vi. Undercut	Shop[3] and field inspection	Y	Perform[4]		
vii. Porosity	Shop[3] and field inspection	Y	Perform[4]		
d. Verify arc strikes	Shop[3] and field inspection	Y	Perform[4]		
e. Verify k-area (When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in.of the weld)	Shop[3] and field inspection	Y	Perform[4]		
f. Verify weld access holes in rolled heavy shapes and built-up heavy shapes (After rolled heavy shapes (see Section A3.1c) and built-up heavy shapes (see Section A3.1d) are welded, visually inspect the weld access hole for cracks)	Shop[3] and field inspection	Y	Perform[4]		
g. Verify backing removed and weld tabs removed (if required)	Shop[3] and field inspection	Y	Perform[4]		
h. Verify repair activities	Shop[3] and field inspection	Y	Perform[4]		
i. Document acceptance or rejection of welded joint or member	Documentation	Y	Perform[4]		
j. Verify no prohibited welds have been added without the approval of the SEOR	Shop[3] and field inspection	Y	Observe[4]		
6. Nondestructive testing (NDT) of welded joints.					
a. Complete penetration groove welds 5/16" or greater in *risk category* III or IV	Shop[3] or field ultrasonic testing - 100%	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
b. Complete penetration groove welds 5/16" or greater in *risk category* II	Shop[3] or field ultrasonic testing - 10% of welds minimum	Y	Periodic		
c. Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop[3] or field radiographic or Ultrasonic testing	Y	Periodic		
d. Fabricator's NDT reports when fabricator performs NDT	Verify reports	Y	Each submittal[5]		
7. Structural steel bolting: Inspection tasks prior to bolting.					
a. Verify manufacturer's certifications available for fastener materials	Shop[3] and field inspection	Y	Perform[4]		
b. Verify fasteners marked in accordance with ASTM requirements	Shop[3] and field inspection	Y	Observe[4]		
c. Verify correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	Shop[3] and field inspection	Y	Observe[4]		
d. Verify correct bolting procedure selected for joint detail	Shop[3] and field inspection	Y	Observe[4]		
e. Verify connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	Shop[3] and field inspection	Y	Observe[4]		
f. Verify pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used	Shop[3] and field inspection	Y	Observe[4]		
g. Verify protected storage provided for bolts, nuts, washers and other fastener components	Shop[3] and field inspection	Y	Observe[4]		
8. Structural steel bolting: Inspection tasks during bolting.					
a. Verify fastener assemblies placed in all holes and washers and nuts are positioned as required	Shop[3] and field inspection	Y	Observe[4]		
b. Verify joint brought to the snug-tight condition prior to the pretensioning operation	Shop[3] and field inspection	Y	Observe[4]		
c. Verify fastener component not turned by the wrench prevented from rotating	Shop[3] and field inspection	Y	Observe[4]		
d. Verify fasteners are pretensioned in accordance with the RCSC Specification, progressing systematically from the most rigid point toward the free edges	Shop[3] and field inspection	Y	Observe[4]		
e. Pre-tensioned and slip-critical joints					
i. Turn-of-nut with matching markings		Y	Periodic		
ii. Direct tension indicator		Y	Periodic		
iii. Twist-off type tension control bolt		Y	Periodic		
iv. Turn-of-nut without matching markings		Y	Continuous		
v. Calibrated wrench		Y	Continuous		
f. Snug-tight joints		Y	Periodic		
9. Structural steel bolting: Inspection tasks after bolting.					
a. Document acceptance or rejection of bolted connections	Documentation	Y	Perform		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
10. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop[3] or field inspection	Y	Periodic		
11. Inspection of anchor rods and other embedments supporting structural steel (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Periodic		
12. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		
1705.2.2 Cold-Formed Steel Deck					
1. Inspection tasks prior to deck placement					
a. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	Shop[3] and field inspection	Y	Perform[4]		
b. Document acceptance or rejection of deck and deck accessories	Documentation	Y	Perform[4]		
2. Inspection tasks after deck placement					
a. Verify compliance of deck and all deck accessories installation with construction documents	Shop[3] and field inspection	Y	Perform[4]		
b. Verify deck materials are represented by the mill certifications that comply with the construction documents	Shop[3] and field inspection	Y	Perform[4]		
c. Document acceptance or rejection of installation of deck and deck accessories	Documentation	Y	Perform[4]		
3. Inspection tasks prior to welding					
a. Welding procedure specifications (WPS) available	Shop[3] and field inspection	Y	Observe[4]		
b. Manufacturer certifications for welding consumables available	Shop[3] and field inspection	Y	Observe[4]		
c. Material identification (type/grade)	Shop[3] and field inspection	Y	Observe[4]		
d. Check welding equipment	Shop[3] and field inspection	Y	Observe[4]		
4. Inspection tasks during welding					
a. Use of qualified welders	Shop[3] and field inspection	Y	Observe[4]		
b. Control and handling of welding consumables	Shop[3] and field inspection	Y	Observe[4]		
c. Environmental conditions (wind speed, moisture, temperature)	Shop[3] and field inspection	Y	Observe[4]		
d. WPS followed	Shop[3] and field inspection	Y	Observe[4]		
5. Inspection tasks after welding					
a. Verify size and location of welds, including support, sidelap, and perimeter welds	Shop[3] and field inspection	Y	Perform[4]		
b. Welds meet visual acceptance criteria	Shop[3] and field inspection	Y	Perform[4]		
c. Verify repair activities	Shop[3] and field inspection	Y	Perform[4]		
d. Document acceptance or rejection of welds	Documentation	Y	Perform[4]		
6. Inspection tasks prior to mechanical fastening					
a. Manufacturer installation instructions available for mechanical fasteners	Shop[3] and field inspection	Y	Observe[4]		
b. Proper tools available for fastener installation	Shop[3] and field inspection	Y	Observe[4]		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
c. Proper storage for mechanical fasteners	Shop[3] and field inspection	Y	Observe[4]		
7. Inspection tasks during mechanical fastening					
a. Fasteners are positioned as required	Shop[3] and field inspection	Y	Observe[4]		
b. Fasteners are installed in accordance with manufacturer's instructions	Shop[3] and field inspection	Y	Observe[4]		
8. Inspection tasks after mechanical fastening					
a. Check spacing, type, and installation of support fasteners	Shop[3] and field inspection	Y	Perform[4]		
b. Check spacing, type and installation of sidelap fasteners	Shop[3] and field inspection	Y	Perform[4]		
c. Check spacing, type, and installation of perimeter fasteners	Shop[3] and field inspection	Y	Perform[4]		
d. Verify repair activities	Shop[3] and field inspection	Y	Perform[4]		
e. Document acceptance or rejection of mechanical fasteners	Documentation	Y	Perform[4]		
1705.2.3. Open-Web Steel Joists and Joist Girders					
1. Installation of open-web steel joists and joist girders.					
a. End connections - welding or bolted.	per SJI CJ or SJI 100	N	Periodic		
b. Bridging - horizontal or diagonal.					
1) Standard bridging.	per SJI CJ or SJI 100	N	Periodic		
2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.		N	Periodic		
1705.2.4. Cold-Formed Steel Trusses Spanning 60 feet or Greater					
1. Verify temporary installation restraint/bracing and permanent individual member restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.3 Concrete Construction					
1. Inspect reinforcement, including prestressing tendons, and verify placement.	Shop[3] and field inspection	Y	Periodic		
2. Reinforcing bar welding:					
a. Verify weldability of bars other than ASTM A706.	Shop[3] and field inspection	Y	Periodic		
b. Inspection of single-pass fillet welds, maximum 5/16".	Shop[3] and field inspection	Y	Periodic		
c. Inspect all other welds.	Shop[3] and field inspection	Y	Continuous		
3. Inspection of anchors cast in concrete.	Shop[3] and field inspection	Y	Periodic		
4. Inspection of anchors and reinforcement post-installed in hardened concrete[6]					
a. Adhesive anchors installed in horizontal or upward-inclined orientation, and reinforcement installed in any orientation:					
i. Verify hole drilling method in accordance with the MPII	Field inspection	Y	Continuous		
ii. Verify anchor edge distance and spacing	Field inspection	Y	Continuous		
iii. Verify hole diameter and depth	Field inspection	Y	Continuous		
iv. Verify hole cleaning in accordance with the MPII	Field inspection	Y	Continuous		
v. Verify anchor element type, material, diameter, and length	Field inspection	Y	Continuous		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
vi. Verify adhesive identification and expiration date	Field inspection	Y	Continuous		
vii. Verify adhesive installation in accordance with the MPII	Field inspection	Y	Continuous		
viii. Verify installer certification in accordance with ACI/CRSI Adhesive Anchor Installer Certification program	Verify	Y	Each Installer		
b. Proof loading[7]	Field testing	Y	Periodic[7]		
c. Mechanical and adhesive anchors not defined in 4a:					
i. Verify hole drilling method in accordance with the MPII	Field inspection	Y	Periodic		
ii. Verify anchor edge distance and spacing	Field inspection	Y	Periodic		
iii. Verify hole diameter and depth	Field inspection	Y	Periodic		
iv. Verify hole cleaning in accordance with the MPII	Field inspection	Y	Periodic		
v. Verify anchor element type, material, diameter, and length	Field inspection	Y	Periodic		
vi. Verify adhesive identification and expiration date	Field inspection	Y	Periodic		
vii. Verify adhesive installation in accordance with the MPII	Field inspection	Y	Periodic		
5. Verify use of approved design mix	Shop[3] and field inspection	Y	Periodic		
6. Prior to placement, fabricate specimens for strength tests, perform slump and air content tests, determine the temperature of the concrete, and perform any other tests as specified in construction documents.	Shop[3] and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop[3] and field inspection	Y	Continuous		
8. Verify maintenance of specified curing temperature and techniques	Shop[3] and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:					
a. Application of prestressing forces	Shop[3] and field inspection	N	Continuous		
b. Grouting of bonded prestressing tendons	Shop[3] and field inspection	N	Continuous		
10. Inspect erection of precast concrete members					
a. Verify member locations and joint details comply with construction and erection documents	Field Inspection	N	Periodic		
b. Verify proper bearing pad type and placement	Field Inspection	N	Periodic		
c. Verify placement of grout (including hot and cold weather procedures and that maximum specified number of levels to be placed before grouting are not exceeded)	Field Inspection	N	Periodic		
d. Verify joint widths are within specified tolerance where joints are to receive sealant	Field Inspection	N	Periodic		
e. Verify thread engagement and torque for mechanical connections	Field Inspection	N	Periodic		
f. Verify tilt-up concrete wall panel connections to slab on grade and foundation comply with construction documents	Field Inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
11. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	N	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions of the concrete member being formed.	Field inspection	N	Periodic		
a. Prior to each concrete placement, verify that a professional engineer who specializes in shoring design has inspected the shoring and reshoring for conformance with the shoring and reshoring plans	Verify	N	Periodic		
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
1705.4 Masonry Construction					
MINIMUM VERIFICATION REQUIREMENTS					
(A) Level 1, 2 and 3 Quality Assurance:					
1. Prior to construction, verification of compliance of submittals	Submittal Review	N	Prior to Construction		
(B) Level 2 & 3 Quality Assurance:					
1. Prior to construction verification of f'm and f'_{AAC} except where specifically required by the code	Testing by unit strength method or prism test method	N	Prior to Construction		
2. During construction, verification of Slump Flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to project site.	Testing by unit strength method or prism test method	N	Periodic		
(C) Level 3 Quality Assurance:					
1. During construction, verification of f'm and f'_{AAC} for every 5,000 SF	Testing by unit strength method or prism test method	N	Periodic		
2. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection	N	Periodic		
MINIMUM SPECIAL INSPECTION REQUIREMENTS					
(D) Levels 2 and 3 Quality Assurance:					
1. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of the site-prepared mortar	Field inspection	N	Periodic		
b. Grade and size of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field Inspection	N	Periodic		
d. Prestressing technique	Field Inspection	N	Periodic		
e. Properties of thin-bed mortar for AAC masonry (b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet	Field Inspection	N	Level 2: Continuous[(b)] Level 2: Periodic[(c)]		
		N	Level 3: Continuous		
f. Sample panel construction	Field Inspection	N	Level 2: Periodic		
		N	Level 3: Continuous		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space	Field Inspection	N	Level 2: Periodic		
		N	Level 3: Continuous		
b. Placement of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Placement of reinforcement, connectors, and anchor bolts	Field inspection	N	Level 2: Periodic		
		N	Level 3: Continuous		
d. Proportions of site-prepared grout and prestresssing grout for bonded tendons	Field Inspection	N	Periodic		
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	N	Periodic		
b. Placement of masonry units and mortar joint construction	Field Inspection	N	Periodic		
c. Size and location of structural members	Field inspection	N	Periodic		
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	Field inspection	N	Level 2: Periodic		
		N	Level 3: Continuous		
e. Welding of reinforcement	Field inspection	N	Continuous		
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)	Field inspection	N	Periodic		
g. Application and measurement of prestressing force	Field testing	N	Continuous		
h. Placement of grout and prestressing grout for bonded tendons is in compliance	Field inspection	N	Continuous		
i. Placement of AAC masonry units and construction of thin-bed mortar joints (b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet	Field inspection	N	Level 2: Continuous[(b)] Level 2: Periodic[©]		
		N	Level 3: Continuous		
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	N	Level 2: Periodic		
		N	Level 3: Continuous		
5. Inspection of anchors post-installed in solid grouted masonry: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, masonry unit, grout, masonry compressive strength, anchor embedment and tightening torque	Field inspection	N	Periodic or as required by the research report issued by an approved source		
1705.5 Wood Construction					
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review[3]	N	Periodic		
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection	N	Periodic		
4. Metal-plate-connected wood trusses:					
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection	N	Periodic		
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of compacted fill materials.	Field inspection	Y	Periodic		
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, inspect subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection		Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform tests and additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents		
8. Perform additional inspections and tests in accordance with the construction documents	Field inspection and Testing	N	In accordance with construction documents		
1705.8 Cast-in-Place Deep Foundations					
1.Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
4. Perform additional inspections and tests in accordance with the construction documents	Field inspection and Testing	N	In accordance with construction documents		
1705.9 Helical Pile Foundations					
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other installation data as required by construction documents.	Field inspection	N	Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field inspection and Testing	N	In accordance with construction documents		
1705.10 Fabricated items					
1. List of fabricated items requiring special inspection during fabrication:	Shop inspection		As noted in each applicable shop activity		
2. List of fabricated items to be fabricated on the premises of a fabricator approved to perform such work without special inspection (including name of approved agency providing periodic auditing):					
1705.11.1 Structural Wood Special Inspections For Wind Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Shop[3] and field inspection	N	Periodic		
1705.11.2 Cold-formed Steel Special Inspections For Wind Resistance					
1.Inspection during welding operations of elements of the main windforce-resisting system	Shop[3] and field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
2. Inspection of screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop[3] and field inspection	N	Periodic		
1705.11.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections.	Shop[3] and field inspection	N	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop[3] and field inspection	N	Periodic		
1705.12.1 Structural Steel Special Inspections for Seismic Resistance					
1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop[3] and field inspection	N	In accordance with AISC 341		
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop[3] and field inspection	N	In accordance with AISC 341		
1705.12.2 Structural Wood Special Inspections for Seismic Resistance					
1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Field inspection	N	Continuous		
2. Nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, shear panels and hold-downs for SDC C, D, E or F.	Shop[3] and field inspection	N	Periodic		
1705.12.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop[3] and field inspection	N	Periodic		
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop[3] and field inspection	N	Periodic		
1705.12.4 Designated Seismic Systems Verification Special Inspections for Seismic Resistance					
For SDC C, D, E or F, inspect and verify that that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.2.	Field inspection	N	Periodic		
1705.12.5 Architectural Components Special Inspections for Seismic Resistance					
1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
2. For SDC D, E or F, inspection during the erection and fastening of interior nonbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection	N	Periodic		
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonbearing walls more than 30 feet above grade or walking surface.	Field inspection	N			
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.12.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection	N	Periodic		
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection	N	Periodic		
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection	N	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection	N	Periodic		
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:					
a. ASCE/SEI 7, Section 13.2.3 minimum required clearances have been provided.	Field inspection	N	Periodic		
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection	N	Periodic		
1705.12.7 Storage Racks Special Inspections for Seismic Resistance					
Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
1705.12.8 Seismic Isolation Systems					
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop and field inspection	N	Periodic		
1705.12.9 Cold-formed Steel Special Bolted Moment Frames					
Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
1705.13.1 Structural Steel Testing for Seismic Resistance					
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in 1 above including struts, collectors, chords and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
1705.13.2 Seismic Certification of Nonstructural Components					
Review certificate of compliance for nonstructural components components in structures assigned to SDC B, C, D, E or F.	Certificate of compliance review	N	Each submittal		
1705.13.3 Seismic Certification of Designated Seismic Systems					
Review certificate of compliance for designated seismic system components in structures assigned to SDC C, D, E or F	Certificate of compliance review	N	Each submittal		
1705.13.4 Seismic Isolation Systems					
Test seismic isolation system in accordance with ASCE 7 Section 17.8 in structures assigned to SDC B, C, D, E or F.	Prototype testing	N	Per ASCE 7		
1705.14 Sprayed Fire-resistant Materials					
1. Verify surface condition preparation of structural members	Field inspection	N	Periodic		
2. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection	N	Periodic		
3. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	N	Per IBC Section 1705.14.5		
4. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	N	Per IBC Section 1705.14.6		
5. Condition of finished application	Field inspection	N	Periodic		
1705.15 Mastic and Intumescent Fire-Resistant Coatings					
Inspect and test mastic and intumescent fire-resistant coatings applied to structural elements and decks per AWCI 12-B	Field inspection and testing	N	Periodic		
1705.16 Exterior Insulation and Finish Systems (EIFS)					

SCHEDULE OF SPECIAL INSPECTIONS SERVICES (IBC 2018: Chapter 17)					
PROJECT	**JACKSON COUNTY AIRPORT - TERMINAL AREA DEVELOPMENT**				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT[1]**	**DATE COMPLETED**
Inspection of water-resistive barrier over sheathing substrate	Field inspection	N	Periodic		
1705.17 Fire-Resistant Penetrations and Joints					
1. Inspect penetration firestop systems	Field testing	N	Per ASTM E2174		
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E2393		
1705.18 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to concealment	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	N	Periodic		

INSPECTION AGENTS[2]			
FIRM		**ADDRESS**	**TELEPHONE NO.**
1.			
2.			
3.			
4.			

Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional.

2. The list of Special Inspectors may be submitted as a separate document, if noted so above.

3. Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1709.2.

4. Observe: Observe on a random basis, operations need not be delayed pending these inspections. Perform: These tasks shall be performed for each welded joint, bolted connection, or steel element.

5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N6.

6. Special inspections shall be in accordnace with the research report issued for the specific anchor, but not less than specified in this section and the Contract Documents.

7. Proof load testing is required at 10% (but not less than two) of all post installed adhesive anchors. Testing shall be performed per the proof loading requirements of ACI 355.4-11 Section 13.3.4. These anchors shall be selected at random by the special inspector. Where 100% of anchors do not pass tests, a further 50% of all installed anchors shall be tested. Adhesive anchors not requiring proof testing shall be explicitly denoted in the Construction Documents.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*? **YES**

Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*? **NO**

DATE: 1/29/2024

FINAL REPORT OF SPECIAL INSPECTIONS

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

_____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: _____

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered___to___form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

_____

_____

_____

_____

_____

(Attach 8 ½"x11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

_____
Special Inspection Agent/Firm

_____
Type or print name

_____
Signature Date

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind or seismic force-resisting system, designated seismic system or wind or seismic-resisting component listed in the Statement of Special Inspections, Special Inspections for Seismic or Wind Resistance, must submit a Statement of Responsibility.

Project:_____

Contractor's Name:_____

Address:_____

License No.:_____

Description of building systems and components included in Statement of Responsibility:

_____
_____
_____
_____
_____
_____
_____

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to obtain conformance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the International Building Code must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:_____

Fabricator's Name:_____

Address:_____

Certification or Approval Agency:_____

Certification Number:_____

Date of Last Audit or Approval:_____

Description of structural members and assemblies that have been fabricated:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

SECTION 014200

REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DEFINITIONS:

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

B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases.

D. Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

G. Install: The term "install" is used to describe operations at project site including the actual "unloading, temporary storage, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. Installer:

1. An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

2. The term "experienced," when used with the term "Installer," means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

3. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project.

1. The extent of the Project Site is shown on the Drawings, and may or may not be identical with the description of the land on which the Project is to be built.

2. If areas available are not indicated, they will be as mutually agreed by Owner and Contractor at Preconstruction Conference and as modified during construction.

K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION:

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's MASTERFORMAT numbering system with 49-Division format.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language:
   a. Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate.
   b. Words that are implied, but not stated shall be interpolated as the sense required.
   c. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.

2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.4 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where 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 the standard in effect as of the date of the Contract Documents.

C. Conflicting Requirements:

1. Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.

2. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

D. Copies of Standards:

1. Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

2. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

1.5 DRAWING SYMBOLS:

A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols are defined by "Architectural Graphic Standards".

B. Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical drawings are generally aligned with symbols recommended by ASHRAE. Where appropriate, these symbols are supplemented by more specific symbols as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Architect/Engineer for clarification before proceeding.

1.6 SUBMITTALS:

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records

established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS: (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000
TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 TEMPORARY FACILITIES:

A. Proper provision shall be made for storage of bulk materials, parking of construction vehicles and direct access to the building site as acceptable to the Owner and approved by the Architect.

B. Site Parking: On-site parking will be available to the Contractor with the "staging areas" indicated, or if not indicated, as agreed to and designated by the Owner.

C. Field Offices: Provide temporary field offices of sufficient size to accommodate Contractor's requirements at the project site. Furnish and equip offices with not less than the following:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings, equipped with table and chairs.
3. Private toilet facility with water closet, lavatory and medicine cabinet with mirror.
4. Drinking water and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor habitable temperatures.
6. Lighting fixtures capable of maintaining average illumination of 20 foot-candles at desk height
7. Digital camera having no less than 5 megapixels resolution, with 5× zoom, for daily construction documentation at the site, including flash, memory cards, charger and rechargeable batteries, standard batteries as back-up or for primary use, and all standard accessories and hardware for equipment, for complete and proper operation, and for downloading and emailing.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations as required.

1.3 TOILET FACILITIES:

A. Contractor shall provide temporary toilet facilities on site for the duration of the project, for construction personnel use. They shall be enclosed weatherproof and sanitary toilets.

1. Maintain toilets in sanitary condition at all times. Remove outside toilets when no longer required, and leave site in clean condition.

2. Conform to local ordinances and regulations.

B. Toilet facilities in the Owner's buildings are not available to, and shall not be used by, the Contractor, subcontractors, and construction personnel.

1.4 TEMPORARY TELEPHONES:

A. Provide telephone for Contractor and Architect in the Contractor's job office at the project site, or if no on-site office is provided, provide a portable or cellular telephone to the Contractor's Superintendent. Cost of service and local calls shall be paid by General Contractor. Long distance and toll calls shall be paid by the party making such calls.

B. Provide telephone answering machine or service (or "voice mail" for cellular phone), to facilitate communication with the Contractor's superintendent.

1.5 TEMPORARY BARRIERS AND FENCES:

A. Contractor shall provide and maintain adequate fencing, barricades and protective walkways where required to provide suitable protection for employees, children, and the public at all times until completion of the work, acceptable to authorities having jurisdiction.

B. The Contractor shall confine the activities of work on this project to within the protected areas, unless otherwise directed by the Architect or Owner.

1.6 ELECTRIC POWER SERVICE:

A. Provide temporary electrical service, including extensions and connections required for construction work.

1. Contractor shall pay electric-power-service use charges for electricity used by all entities for construction operations, including costs of installing and maintaining service for duration of project.

2. Contractor shall also pay costs associated with use of permanent electrical system when operational until Date of Substantial Completion.

B. The Contractor shall be responsible for all extensions, connections and associated servicing items as necessary for the Work. Contractor shall remove all temporary wiring, extensions, connections and related items, prior to Substantial Completion.

C. The Contractor shall protect the Owner's systems from outage or damage, and repair of any damage to at least its previously existing condition - subject to the Owner's approval.

1.7 WATER AND SEWER SERVICES:

A. Provide temporary water and sewer service for construction purposes, including extensions and connections required.

1. Contractor shall pay water and sewer service use charges for usage by all entities for construction operations, including costs of installing and maintaining service for duration of project.

2. Contractor shall also pay costs associated with use of permanent water system when operational until Date of Substantial Completion.

B. The Contractor shall provide temporary stub-up, hose bib and connections as necessary for the Work. Contractor shall remove all temporary piping, valves, and associated connections prior to substantial completion.

C. The Contractor shall protect the Owner's water and sewer systems, new and temporary water lines, valves, and related connections from freezing, damage and contamination, and repair of any damage to the Owner's water systems to at least its previously existing condition - subject to the Owner's approval.

D. Contractor shall be responsible for any and all costs associated with the procurement and installation of any new meters, including all fees for service connection, permits, tap fees, and impact fees. The cost shall be included in the Contract amount as part of the Work.

1.8 TEMPORARY HEAT AND VENTILATION:

A. Contractor shall furnish temporary heat as required for uninterrupted construction and other operations, protection of new work, for drying out buildings, curing of materials and controlling humidity in enclosed spaces where required.

1. Provide temporary heating in enclosed spaces to provide minimum temperatures of 40-deg. F. until time finishing work begins.

2. After building is totally enclosed and installation of finishes begins, maintain spaces in a temperature range of 60-deg. F. to 80-deg. F. at all times, except as may otherwise be required by product manufacturers for proper product installation and performance. Maintain until Date of Substantial Completion

B. Provide ventilation to prevent accumulation of dust, fumes or gases and to properly cure materials and disperse humidity.

1.9 ENCLOSURES AND PROTECTION:

A. Provide and maintain for the duration of construction of scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges and other temporary construction necessary for proper completion and observation of the work, in compliance with pertinent safety and other regulations, and authorities having jurisdiction.

1.10 PROJECT SIGNS:

A. Provide one project sign installed at locations on job site as directed by Architect.

1. Construct signs using 3/4- thickness, APA Medium Density Overlay, EXT, plywood; approximate size of 8-ft. by 12-ft., painted in not more than three colors.

2. Support signs with 4-inch by 4-inch wood posts set in ground. Provide additional bracing and framing for rigid installation.

3. Coordinate sign design with Architect.

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

C. Protect installed signs from construction damage for duration of project.

1.11 CLEAN UP:

A. The Contractor or his agent, upon completion of the work shall immediately remove all temporary fences, temporary utility lines, debris or any other obstructions and leave such property in as good a condition as it was before such work was commenced.

B. The Contractor, upon completion of the work, shall remove all other temporary structures and facilities from the site.

C. The Contractor shall legally dispose of all trash, debris, and waste off site, on a regular basis.

D. Items salvaged by Contractor for his own purposes or for the Owner where indicated, may be stored temporarily on site and removed as soon as possible, unless directed otherwise by Architect, or Owner.

E. The sale or advertising for sale of salvaged or other materials shall not be permitted on site under any circumstances.

F. Control dust on site and clean mud and/or debris from on site and city streets and sidewalks, as it occurs.

G. Provide facilities to wash mud off of truck tires, equipment and construction vehicles before it can be tracked onto streets, roads or public thoroughfares.

END OF SECTION 015000

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY

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

1.3 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" 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. The Architect shall be the sole judge in determining the acceptability of the product submitted to be comparable to the one specified as the Basis of Design.
   2. Should product submitted be determined by the Architect as not comparable to the Basis of Design, Contractor shall be responsible for providing the specified Basis of Design product without additional cost.

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

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request.
a. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15**)** days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. 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 material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
a. Form of Acceptance: Change Order.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

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.

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. Store cementitious products and materials on elevated platforms.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

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.

B. Submittal Time: Comply with requirements in Division 1 Section "Project Closeout."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. 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: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.

a. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
b. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample.
1. Architect's decision will be final on whether a proposed product matches.
2. If no product is available within specified category matches and complies with other specified requirements, comply with requirements in "Product Substitution" Article for proposal of product.

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

2.2 PRODUCT SUBSTITUTIONS

A. Requests for substitution shall reach the Architect not less than ten (10) calendar days prior to the date set for Bid opening. Requests received by Architect after this date will not be considered.

B. Architect will consider Contractor's request for substitution in accordance with conditions and procedures described in the Instructions to Bidders.

C. Conditions for Consideration: Architect will consider Contractor's request for substitution when the following conditions are satisfied.
1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include

compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. 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.

D. Architect will determine acceptability of proposed substitutions. In accepting a substitution the Architect does not warrant that the product meets all expressed requirements of the Contract Documents. The approved substitution is subject to the same subsequent review and approval procedures as the products originally specified.

1. Determination as to acceptability of proposed substitutions will be made based only on data submitted.
2. Substitute products shall not be ordered or installed without written acceptance by the Architect.

E. Contractor shall coordinate installation of accepted substitutions with interfacing work, bearing re-design costs and making approved changes in the Work to properly incorporate the substitutions, and shall waive all claims for additional costs related to use of acceptable substitutions which become apparent following acceptance.

2.3 COMPARABLE PRODUCTS

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017329
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definition:
1. Cutting and patching includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.
2. Cutting and patching is performed for coordination of the Work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.
3. Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

1.3 SUBMITTALS:

A. Procedural Proposal for Cutting and Patching:
1. Where prior approval of cutting and patching is required, submit proposed procedures for this work well in advance of the time work will be performed and request approval to proceed. Include the following information, as application, in the submittal.
2. Describe nature of the work and how it is to be performed, indicating why cutting and patching cannot be avoided. Describe anticipated results of the work in terms of changes to existing work, including structural, operational and visual changes as well as other significant elements.
3. List products to be used and firms that will perform work.
4. Give dates when work is expected to be performed.
5. List utilities that will be disturbed or otherwise be affected by work, including those that will be relocated and those that work be out-of-service temporarily. Indicate how long utility service will be disrupted.
6. Approval by the Architect/Engineer to proceed with cutting and patching work does not waive the Architect/Engineer's right to later require complete removal and replacement of work found to be cut and patched in an unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Except as otherwise indicated, or as directed by the Architect/Engineer, use materials for cutting and patching that are identical to specified materials. If identical materials are not available, or cannot be used, use materials that match adjacent surfaces to the fullest extent possible with regard to visual effect.
   1. Use materials for cutting and patching that will result in equal-or-better performance characteristics.
   2. Comply with applicable specification sections for type of work to be performed.

PART 3- EXECUTION

3.1 INSPECTION:

A. Before cutting, examine the surfaces to be cut and patched and the conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

3.2 PREPARATION:

A. Temporary Support: To prevent failure provide temporary support of work to be cut.

B. Protection:
   1. Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.
   2. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
   3. Take precautions not to cut existing pipe, conduit or duct serving the building but scheduled to be relocated until provisions have been made to bypass them.

3.3 PERFORMANCE:

A. General: Employ skilled workmen to perform cutting and patching work. Except as otherwise indicated or as approved by the Architect/Engineer, proceed with cutting and patching at the earliest feasible time and complete work without delay.

B. Cutting:
   1. Cut the work using methods that are least likely to damage work to be retained or adjoining work. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.
   2. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to insure

a neat hole. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.

C. Patching:
1. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.
2. Where feasible, inspect and test patched areas to demonstrate integrity of work.
3. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
4. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coat.
5. Patch, repair or rehang existing ceilings as necessary or called for on plans to provide an even plane surface of uniform appearance.

3.4 CLEANING:

A. Thoroughly clean areas and spaces where work is performed or used as access to work. Remove completely point, mortar, oils, putty and items of similar nature.

B. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 017329

SECTION 017720
PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definitions:

1. Project closeout is the term used to describe certain collective project requirements, indicating completion of the Work that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the Work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

2. Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 33.

3. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates, if the Work is to be completed in phases. This time variation, if any, shall be applicable to the other provisions of this section.

1.3 PREREQUISITES TO SUBSTANTIAL COMPLETION:

A. General: Complete the following before requesting the Architect/Engineer's inspection for certification of substantial completion, either for the entire Work or for portions of the Work, if the Work is to be completed in phases. List known exceptions in the request.

1. Inspection Procedures:
   a. The Contractor shall conduct their own complete Prefinal Inspections, distribute punch-lists to all trades, the Owner, Architect and their Consultants, and complete all resulting work items, prior to any Final Inspection by the Architect or their Consultants.
   b. Following the Contractor's completion of work resulting from their own inspection(s), and upon receipt of the Contractor's request for inspection, the Architect/Engineer will either proceed with inspection or advise the Contractor of unfilled prerequisites.
   c. Following the initial inspection, the Architect/Engineer will either prepare the certificate of substantial completion, or will advise the Contractor of work which must be performed before the certificate will be issued. The Architect/Engineer will repeat the inspection when requested and when assured that the Work has been substantially completed.

d. Results of the completed inspection will form the initial "punch-list" for "final acceptance".

2. In the progress payment request that coincides with, or is the first request following, the date substantial completion is claimed, show either 100% completion for the portion of the Work claimed as "substantially complete", or list incomplete items, the value of incomplete work, and reasons for the Work being incomplete.

3. Submit a statement showing an accounting of changes to the Contract Sum.

4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

5. Obtain and submit releases enabling the Owner's unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates, and other similar releases.

6. Deliver tools, spare parts, extra stock of material, and similar physical items to the Owner.

7. Make the final change-over of locks and transmit the keys to the Owner. Advise the Owner's personnel of the change-over in security provisions.

8. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mock-ups, and similar elements.

1.4 PREREQUISITES TO FINAL ACCEPTANCE:

A. General: Complete the following before requesting the Architect/Engineer's final inspection for certification of final acceptance, and final payment as required by the General Conditions. List known exceptions, if any, in the request.

1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Architect/Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and which has been endorsed and dated by the Architect/ Engineer.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar date either as of the date of substantial completion, or else when the Owner or subsequent Contractor took possession of and responsibility for corresponding elements of the Work.

5. Submit consent of surety.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

7. Include supporting documentation for completion as indicated in these contract documents.

B. Re-inspection Procedure:

1. The Architect/Engineer will re-inspect the Work upon receipt of the Contractor's notice that the Work, including punch-list items resulting from earlier inspections, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect/Engineer.

2. Upon completion of re-inspection, the Architect/Engineer will either prepare a certificate of final acceptance, or will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

3. If necessary, the re-inspection procedure will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS:

A. Time of Submittal: Submit project record documents within ten (10) days of acceptance of the entire completed project.

B. Record Drawings and Project Manual: Submit record drawings and project manuals with specifications according to requirements specified in Division 01 Section "Project Record Documents." Include in set mechanical, plumbing, fire protection and electrical record drawings and specifications. Obtain Architect's review and acceptance of documents prior to submittal.

1. Originals: Submit one original marked-up set. Original documents shall include recorded colored markings as specified in Project Record Documents section and maintained throughout construction.

2. Digital Copies: Submit two (2) digital copies in latest edition of ISO/Adobe compliant "Portable Document Format" (PDF) saved as "Read Only" on compact discs (CD's), clearly and permanently labeled as to their contents. Minimum Resolution shall be 300 dpi for small format documents and 600 dpi for large format documents ("large format" is defined as larger than 11-inches by 17-inches).
   a. Original documents shall be scanned and saved in color. Documents may be saved in a non-proprietary ISO compliant self-extracting compressed file format, and no documents shall be password protected.
   b. Deliver digital copies in standard CD cases or sleeves which are free of any PVC content. Clearly and permanently label cases and disks with contents.

C. Record Samples Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Architect/Engineer and the Owner's personnel, if desired, to determine which, if any, of the submitted samples that have been maintained by the Contractor during progress of the Work, are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's designated storage area for samples.

D. Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with the actual performance of the Work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect/Engineer for the Owner's records.

E. Maintenance Manuals, Warranties, and Guarantees:

1. Unless indicated otherwise, submit one (1) original and one (1) copy of each item required by the Project Manual.

2. Furnish to Architect for review, and then to Owner, in two (2) separate sets bound in three-ring binders, permanently and clearly identifying the project and contents on front and edge.

PART 2 – PRODUCTS

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

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING:

A. General Operating and Maintenance Instructions:

1. Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instruction in the proper operation and maintenance of the entire Work. Where installers are not experienced in the required procedures, include instruction by the manufacturer's representatives.

2. As part of this instruction, provide a detailed review of the following items:
   a. Maintenance manuals
   b. Record documents
   c. Spare parts and materials
   d. Tools
   e. Identification systems
   f. Control sequences
   g. Cleaning procedures
   h. Warranties, bonds, maintenance agreements, and similar continuing commitments.

3. As a part of this instruction for operating equipment, demonstrate the following procedures:
   a. Start-up
   b. Shut-down
   c. Emergency operations
   d. Noise and vibration adjustments

e. Safety procedures
f. Economy and efficiency adjustments
g. Effective energy utilization.

3.2 FINAL CLEANING:

A. General: Special cleaning requirements for specific units of Work are included in the appropriate sections of Divisions 2 through 16. General Cleaning during the regular progress of the Work is required by the General Conditions and is included under section "Temporary Facilities".

B. Cleaning: Provide final cleaning of the Work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with the manufacturer's instructions for operations.

C. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of substantial completion:

1. Clean the project site, including landscape development areas, of rubbish, litter and other foreign substances.

2. Sweep paved areas to a broom clean condition; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

D. Removal of Protection: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

E. Compliance:

1. Comply with safety standards and governing regulations for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.

2. Do not burn waste materials at the site.

3. Do not bury debris or excess materials on the Owner's property.

4. Do not discharge volatile or other harmful or dangerous materials into drainage systems.

5. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these materials to the Owner's best advantage as directed.

END OF SECTION 017720

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY:

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

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous Record Documents.

B. Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in the various “submittals” sections.

C. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistant location; provide access to record documents for the Architect/Engineer’s reference during normal working hours.

1.3 PROJECT RECORD DOCUMENTS:

A. Maintain at least one (1) copy of all drawings, specifications, addenda, approved shop drawings, change orders, filed orders, other contract modifications and other reviewed documents submitted by the Contractor in compliance with various sections of the specifications.

1. Project record documents shall be clearly marked "Project Record Copy," maintained in good condition, available for inspection by the Architect or Owner, and not used for construction purposes.
2. Keep project record documents current. Do not permanently conceal any work until the required information has been recorded.

B. Record Drawings: Maintain a record set of blue or black line white-prints of contract drawings and shop drawings in a clean, undamaged condition.

1. Mark-up the set of record documents to show the actual installation where the installed work varies substantially from the work as originally shown.
   a. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for

mark-up, record a cross-reference at the corresponding location on the contract drawings.

b. Give particular attention to concealed work that would be difficult to measure and record at a later date.

2. Mark drawings to include, but not limited to, the following types of items:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations.
   d. Locations and depths of underground utilities and appurtenances. Locate utilities and appurtenances, referenced to permanent surface improvements by dimensions and descriptions.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Significant details not shown in the original contract documents.

3. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work.

4. Mark-up new information which is known to be important to the Owner, but for same reason was not shown on either contract drawings or shop drawings.

5. Note related change-order numbers where applicable.

6. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Project Manual: Maintain one complete copy of the Project Manual, including specifications and addenda(s), and one copy of other written construction documents such as change orders and similar modifications issued during construction.

1. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   b. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   c. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   d. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.

2. Note related Change Orders, record Product Data, and record Drawings where applicable.

D. Record Product Data: Maintain an annotated PDF electronic file record set of final reviewed product data bearing Architect's submittal review stamp. Include with the record

set a directory identifying each submittal electronically linked to each item of the record product data.

1. Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in product data submittal.
   a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
2. Organize record set of product data, including directory, by specification section number and title.

E. Miscellaneous Record Submittals: Maintain and assemble PDF electronic file of 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. Include a directory identifying each submittal electronically linked to each item of the miscellaneous records.

1. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities.
2. Categories of requirements resulting in miscellaneous records include, but are not limited to, the following:
   a. Field records on excavations and foundations.
   b. Field records on underground construction and similar work.
   c. Survey showing locations and elevations of underground lines.
   d. Invert elevations of drainage piping.
   e. Surveys establishing building lines and levels.
   f. Authorized measurements utilizing unit prices or allowances.
   g. Records of plant treatment.
   h. Ambient and substrate condition tests.
   i. Certifications received in lieu of labels on bulk products.
   j. Batch mixing and bulk delivery records.
   k. Testing and qualification of tradesmen.
   l. Documented qualification of installation firms.
   m. Load and performance testing.
   n. Inspections and certifications by governing authorities.
   o. Leakage and water-penetration tests.
   p. Fire-resistance and flame-spread test results.
   q. Final inspection and correction procedures.
3. Organize miscellaneous records, including directory, by specification section number and title.

PART 2 – PRODUCTS
(NOT USED)

PART 3 - EXECUTION

3.1 RECORDING AND MAINTAINING PROJECT DOCUMENTS:

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.

1. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss.

2. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definitions:

1. Project closeout is the term used to describe certain collective project requirements, indicating completion of the Work that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the Work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

2. Specific requirements for individual units of work are included in the appropriate sections in Divisions 2 through 33.

3. Time of closeout is directly related to “Substantial Completion”; therefore, the time of closeout may be either a single time period for the entire Work or a series of time periods for individual elements of the Work that have been certified as substantially complete at different dates, if the Work is to be completed in phases. This time variation, if any, shall be applicable to the other provisions of this section.

1.1 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

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

1.2 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.3 COORDINATION

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

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.4 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.5 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.6 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, a written and a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.7 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.

1. Submit video recordings thumb drive by loading to web-based Project software site.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 033000 – CAST-IN-PLACE CONCRETE

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. Description:

1. This section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

a. Footings.
b. Slabs-On-Grade.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All cast-in-place concrete work on this project shall conform to the Construction Documents, applicable building code including referenced standards, the requirements of “Specification for Structural Concrete” ACI 301-16 (Chapters 1-5, & Chapters 6-14 as applicable) and "Specifications for Tolerances for Concrete Construction and Materials" ACI 117, in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 03 Specifications – Concrete Construction.
2. Division 07 Specifications – Thermal and Moisture Protection.

1.3 SUBMITTALS

A. Design Mixtures:

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

B. Cold-Weather Placement: Submit detailed procedures for cold weather concreting in accordance with ACI 306.1.

C. Hot-Weather Placement: Submit detailed procedures for hot weather concreting in accordance with ACI 305.1.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Formwork layout and dimension shop drawings.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates

G. Material Certificates: For each of the following as applicable on the project, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Comply with ACI 301.

B. Earth forms may be used for footing forms where sides of the excavation are cut true, in firm soil. If earth is not suitable to be used as “earth form,” no consideration will be given to any claim for additional cost of formwork. Contractor shall provide material and labor to provide formwork without additional cost to Owner.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615 Grade 60 deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706 Grade 60 deformed.

1. For use where weldable reinforcing is called out in construction documents.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Manufacture bar supports from plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete for use in foundations and slabs-on-grade only.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F or C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
c. Use of supplemental cementitious materials may be rejected by Architect/Structural Engineer of Record for certain applications on project.

2. Blended Hydraulic Cement: ASTM C 595, Type IS portland blast-furnace slag, Type IP portland-pozzolan, Type I (PM) pozzolan-modified Portland, Type I (SM) slag-modified portland cement. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

B. Silica Fume: ASTM C 1240, amorphous silica. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Select grading class per type of construction or location used, and in relation to specific weathering region. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: See schedule on Construction Drawings.

D. Water: Shall be potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 FIBER REINFORCEMENT

A. Fiber reinforcement may be requested for substitution by contractor. Architect/Structural Engineer of Record shall review for compliance any substitution requested and approve or reject as necessary.

2.7 WATERSTOPS

A. Coordinate with Division 07 specifications and architectural drawings for waterstop requirements.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder meeting ASTM E 1745, minimum 10 mil thickness. Coordinate with Division 03 and 07 specifications and Architectural Drawings for additional requirements or increased thickness. See Construction Drawings for locations required. Install per qualified geotechnical engineer’s recommendation and ACI 302.1 requirements.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and ACI 318 chapter 5. Design mixtures shall meet the minimum requirements tabulated in the construction documents.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed. Requirements of table 4.1.2.9 of ACI 301 shall be adhered to.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, plasticizing, or retarding admixtures in concrete, as required, for placement and workability, and project specific conditions.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice.”

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete:

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for exposed smooth-formed finished surfaces.
2. Class B, 1/4 inch for exposed rough-formed finished surfaces.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Field bending or straightening of reinforcing bars partially embedded in concrete is prohibited unless specifically permitted by Structural Engineer of Record. Comply with ACI 301 procedures for field bending and straightening.

C. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least two full panels. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.3 CONCRETE PLACEMENT

A. Do not add water to concrete during delivery or at Project site. Add water at project site only as noted on delivery ticket, and prior to beginning placement.

B. Cold-Weather Placement: Comply additionally with ACI 306.1 and as follows:

1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement: Comply additionally with ACI 305.1 and as follows:

1. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

3.4 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish (after applying float finish):

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) **35**; and of levelness, F(L) **25**; with minimum local values of flatness, F(F) **24**; and of levelness, F(L) **17**; for slabs-on-grade.

D. Trowel and Fine-Broom Finish:

1. Apply a trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Coordinate required final finish with Architect before application.

3.5 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301, ACI 305, ACI 306, and ACI 306.1 as applicable.

B. Cure concrete according to ACI 308.1, by one or a combination of the methods allowed in ACI 301.

3.6 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect/Structural Engineer of Record. Remove and replace concrete that cannot be repaired and patched to Architect/Structural Engineer of Record approval.

B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning per ACI 301, to the satisfaction of the Architect/Structural Engineer of Record.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. For areas out of tolerance or specification, Contractor shall propose correction method to Architect/Structural Engineer of Record for approval.

3.7 FIELD QUALITY CONTROL

A. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample set for each 75 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
4. Air Content: ASTM C231 or ASTM C173 as applicable, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Compression Test Specimens: ASTM C 31.
   a. Cast and cure a minimum of four 6"x12" or five 4"x8" cylinder specimens for each composite sample.
   b. Additional cylinders to be cast for high-early strength concrete and as required for contractor's means and methods.
6. Compressive-Strength Tests: ASTM C 39; test one specimen at 7 days and one set of two (6"x12")/three (4"x8") specimens at 28 days. Should 28 day strength not be met, test remaining cylinder at 56 days. Should 28 day strength be met, remaining cylinder may be discarded. Additional tests for high-early strength concrete and as required for contractor's means and methods.

B. Measure floor and slab flatness and levelness according to ASTM E 1155 as soon as possible but within 24 hours of finishing. Elevated framing shall be measured in its shored condition (where applicable).

END OF SECTION 033000

SECTION 042000
UNIT MASONRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section includes unit masonry assemblies consisting of the following:

1. Clay face brick.
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 5 Section - "Cold-Formed Metal Framing."
2. Division 7 Section - "Weather Barriers."
3. Division 7 Section - "Thermal Insulation."
4. Division 7 Section - "Flashing and Sheet Metal."
5. Division 7 Section - "Joint Sealants."
6. Division 8 Section – "Aluminum-Framed Entrances and Storefronts."

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

1. Steel lintels for unit masonry, furnished under Division 5 Section "Metal Fabrications."
2. Hollow metal frames to be built into masonry walls as specified in Division 8 Section "Hollow Metal Doors and Frames."

1.3 PERFORMANCE REQUIREMENTS:

A. Compressive Strength of Masonry: Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1. Concrete Unit Masonry (including AGF-CMU): f'm of not less than 2000 psi.
2. Brick Unit Masonry: f'm of not less than 2500 psi.

B. Structural Performance and Deflection Requirements for Adjustable Masonry Ties: Provide veneer anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Adjustable masonry tie assemblies shall limit total lateral mechanical play to 0.02-inch minimum, and 0.05-inch maximum.
2. Maximum deflection of ties shall be less than 0.05-inch when subjected to an axial load of 100 lbf in tension and compression.
3. Adjustable tie assemblies shall meet deflection requirements when eccentrically loaded per actual installation conditions with provisions for positive vertical and horizontal movement limitations in plane parallel to wall.

C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency or by equivalent concrete masonry thickness method indicated in governing code and as acceptable to authorities having jurisdiction.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's product literature and technical data for items listed as follows:

1. Manufactured mortars, cements and admixtures. Include mixing and installation instructions.
2. Masonry joint reinforcement and accessories, including veneer ties and anchors.
3. Through-wall flashing materials.
4. Miscellaneous masonry accessories, including preformed control joints, compressible filler materials, cavity drainage and weep materials, masonry cleaning compounds and sealers.

B. Shop Drawings: Submit for the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples:

1. For Initial Selection:
   a. Clay Face Brick: Submit samples in small-scale thin brick form showing the full range of colors and textures available for selection.
   b. Colored Mortar: Submit samples showing the full range of colors available.
2. For Verification:
   a. Clay Face Brick: Submit actual brick units of selected color and texture.
   b. Colored Mortar: Make samples of selected color using same sand and mortar ingredients to be used on Project.

c. Weep Holes/Vents and Cavity Drainage Material: Submit samples of actual material to be used.

d. Accessories Embedded in Masonry: Submit samples of each type accessory required to be embedded in masonry.

D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used.

1. Include mix proportions for mortar and grout and source of aggregates.
2. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units: Include data on material properties and material test reports substantiating compliance with requirements.
   a. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
   b. For exposed brick, include test report for efflorescence according to ASTM C 67.
   c. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious Materials: Include brand, type, and name of manufacturer.
3. Packaged, Colored Masonry Cement: Include description of type and proportions of ingredients.
4. Grout Mixes: Include description of type and proportions of ingredients.
5. Reinforcing bars: Provide for each type and size.
6. Joint reinforcement: Provide for each type and size.
7. Anchors, Ties, and Metal Accessories: Provide for each type and size.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements. Submit only when conditions are required to meet construction schedule as authorized by Architect.

1.5 QUALITY ASSURANCE:

A. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1093 for testing indicated as documented according to ASTM E 548.

B. Source Limitations:

1. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
2. Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate. For each type cement specified, only one brand shall be used throughout the project.

C. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials failing to meet specified requirements shall be performed at Contractor's expense.

1. Mortar Test: For mortar properties per ASTM C 270.
2. Grout Test: For compressive strength per ASTM C 1019.

D. Sample Panels: Build sample panels at the project site to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Construct minimum 6-ft. (72-inches) long by 6-ft. (72-inches) high sample wall panel of masonry veneer using specified face brick units and cast stone units laid with gypsum sheathed metal stud backup support framing, mortar and accessories. Orient panel as directed by the Architect.
2. Sample panel shall indicate not less than the following:
   a. Bonding pattern.
   b. Mortar color and joint tooling.
   c. Face brick color and texture.
   d. Joint reinforcement and veneer ties.
   e. Cavity clearance.
   f. Air barrier applied to gypsum sheathed framing back-up.
   g. Through-wall flashing, weeps and cavity drainage materials.
   h. Typical brick expansion joint and concrete masonry unit control joint; sealed with backer rod and sealant.
   i. Fenestration with storefront framing.
   j. Workmanship.
3. Clean one-half of exposed faces of panels with masonry cleaner specified after approval of sample panel and as directed Architect.
4. Prepare panel at least fourteen (14) days prior to beginning masonry work. Should the panel not be accepted, prepare additional panels until accepted by Architect.

5. Protect approved sample panels from the elements with weather-resistant membrane.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

F. Air Barrier Inspection: Obtain Architect's inspection and acceptance of fluid-applied air barrier membrane application before starting installation of masonry veneer construction.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Deliver reinforcement and accessories in bundles or boxes with waterproof tags. Maintain tags attached until material is incorporated into the work.

B. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover in a dry location or in covered weatherproof dispensing silos.

E. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp or wet.

F. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.7 PROJECT CONDITIONS:

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 2-ft. (24-inches) down both sides and hold cover securely in place.

B. Loading Precautions: Do not apply uniform floor or roof loads for at least twelve (12) hours and concentrated loads for at least three (3) days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.

1. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than seven (7) days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 PRODUCTS

2.1 MASONRY UNITS, GENERAL:

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 FACE BRICK

A. Brick Allowance: Allow the sum of Four Hundred Fifty Dollars ($450.00) per thousand net invoice cost F.O.B. project site for furnishing face brick.

B. Face Brick Characteristics:

1. Acceptable Products subject to compliance with specified requirements:
   a. Cherokee Brick Company
2. Grade and Type:
   a. Hollow Brick Units: Meeting ASTM C 652, Grade SW, Type HBS or HBX.
   b. Solid Brick Units: Meeting ASTM C 216, Grade SW, Type FBS or FBX.
3. Size: 3-5/8 inches width by 2-1/4 inches height by 7-5/8 inches length (Actual Dimensions).

4. Color and Texture: Georgia Handcrafted - Old Savannah

2.3 MORTAR AND GROUT MATERIALS:

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: ASTM C 91, non-staining, 18-percent maximum air content by volume and proportioned to comply with requirements of ASTM C270 for Type “S” mortar.

D. Packaged, Colored Masonry Cement:

1. Acceptable Products; subject to compliance with specified requirements:
   a. Argos USA Corp., Magnolia Masonry Cement.
   b. Holcim (US) Inc.; Rainbow Mortamix Custom Masonry Cement.
   c. Lehigh Hanson / Heidelburg Cement Group; Flamingo-Brixment Colored Masonry Cement.
   d. National Cement Company, Inc., Coosa Masonry Cements.
2. Characteristics: Factory prepared, non-staining masonry cement meeting ASTM C 91, composed of inert alkali-resistant and fade resistant mineral pigments, portland cement or blended cement, plasticizers, water-reducing admixtures and air entraining additives; having 22-percent maximum air content by volume and proportioned to comply with requirements of ASTM C 270 for Type 'S' mortar with minimum 28 day compressive strength of 1800 psi.
3. Color: Custom color as selected by the Architect from samples formulated for Type "S" mortar. Color shall be from manufacturer’s white cement based formulations.

E. Aggregate for Mortar: ASTM C 144; for mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone. Provide aggregate from a single source for colored mortar.

F. Aggregate for Grout: ASTM C 404; aggregate sizes as specified for indicated grout types.

1. Fine Grout: Size no. 1 fine aggregate.
2. Coarse Grout: Size no. 8 coarse aggregate, limited to use when minimum horizontal dimensions of grouting space exceeds 4-inches.

G. Cold-Weather Admixture:

1. Acceptable Products subject to compliance with specified requirements:
   a. Euclid Chemical Company (The); Accelguard 80.
   b. GCP Applied Technologies, Inc.; Morset.
   c. BASF Corporation; MasterSet AC 534.
2. Type: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

H. Water: Clean, Potable, free from deleterious amounts of alkalies, acids and organic materials.

2.4 TIES AND ANCHORS MATERIALS:

A. Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

1. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 ADJUSTABLE MASONRY VENEER TIES FOR MASONRY JOINT REINFORCEMENT:

A. Type: Pintle type rectangular sections with turned-down legs designed to fit into eye sections of joint reinforcement; complying with specified design and performance requirements. Ties shall be joint reinforcement manufacturer's compatible products.

1. Material: Fabricated from minimum 3/16-inch diameter specified hot-dip galvanized carbon steel wire.
2. Adjustment Capabilities: Ties shall allow for approximately 1-1/4 inch vertical adjustment.
3. Tie size: Pintle ties shall be sized to extended minimum 2-1/4 inch, maximum 2-3/4 inch, into exterior masonry veneer bed joint of double wythe masonry construction.

B. Location: Provide for installation with joint reinforcement of masonry-back-up in double wythe construction.

2.6 ADJUSTABLE VENEER ANCHOR ASSEMBLIES FOR METAL STUD CONSTRUCTION:

A. Acceptable Product; subject to compliance with specified requirements:

1. Hohmann & Barnard, Inc.; X-Seal Anchor System w/ #VWT Ties.
2. Wirebond / Masonry Reinforcing Corp. of America; Type III-X Anchor w/ No. 1100 or 1501 Ties.

B. Characteristics: Screw-attached, masonry-veneer anchor assemblies consisting of a wire tie and a metal anchor section.

1. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6-inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation and sheathing; with raised rib-stiffened strap, 5/8-inch wide by 6-inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.

a. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch (14-gauge) thick, steel sheet; galvanized after fabrication.

b. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

2. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch (3/16-inch) diameter, hot-dip galvanized steel wire.

C. Fasteners for Attachment to Steel Studs:

1. Acceptable Products; subject to compliance with specified requirements:

a. ITW Buildex; Teks Maxiseal with Climaseal finish.

b. Elco Construction Products / Stanley Engineered Fastening; Elco Dril-Flex with Stalgard finish.

2. Type: Polymer-coated, steel drill screws meeting ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 1000 hours per ASTM B 117.

2.7 WELD-ON TIES FOR ATTACHING TO STRUCTURAL STEEL:

A. Weld-On Column Anchors:

1. Acceptable Products; subject to compliance with specified requirements:

a. Heckman Building Products, Inc.; No. 315 Weld-On Anchor Rods with No. 318 Web Ties.

b. Hohmann & Barnard, Inc., #359 Weld-On Ties with #301W Column Web Ties.

c. Wirebond / Masonry Reinforcing Corp. of America, No. 1000 Type I Weld-On Anchors with No. 1200 Ties

2. Characteristics: Column tie assembly consisting of weld-on steel anchor rod and wire tie fabricated from specified hot-dipped galvanized carbon-steel wire.

a. Weld-On Anchor Rod: 1/4-inch diameter by 9-inch length plain steel rod formed with offset to accept wire ties.

b. Tie: Minimum 3/16-inch diameter cold drawn steel, trapezoid shaped web ties; sizes as required to fit within width of concrete masonry unit by minimum 12-inches (1-ft.) length.

B. Weld-On Beam Anchors:

1. Acceptable Products; subject to compliance with specified requirements:

a. Heckman Building Products, Inc.; No. 315 Weld-On Anchor Rods with No. 316 Triangle Ties.

b. Hohmann & Barnard, Inc., #359 Weld-On Ties with #VWT Vee Wall Ties.

c. Wirebond / Masonry Reinforcing Corp. of America, No. 1000 Type I Weld-On Anchors with No. 1100 Series Triangular Ties.

2. Characteristics: Beam tie assembly consisting of weld-on steel anchor rod and wire tie fabricated from specified hot-dipped galvanized carbon-steel wire.
   a. Weld-On Anchor Rod: 1/4-inch diameter by 9-inch length plain steel rod formed with offset to accept wire ties.
   b. Tie: Minimum 3/16-inch diameter cold drawn steel, triangular shaped ties; sizes as required to extend minimum 2-inches, maximum 2-3/4 inches, into bed joint of exterior masonry veneer wythe.

2.8 BENT WIRE TIES:

A. Type: Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2-inches long.

B. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire.

2.9 RIGID STRAP ANCHORS:

A. Type: Strap anchors fabricated from specified steel bar material.

B. Size and Configuration: 1-1/2 inches wide by 1/4-inch thick by 24-inches long, with ends turned up 2-inches or with cross pins; except for locations where a different size is specifically indicated on the drawings.

C. Finish: Hot-dip galvanized to comply with ASTM A 153.

2.10 MISCELLANEOUS ANCHORS:

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
   1. Headed bolts.
   2. Nonheaded bolts, bent in manner indicated.

B. Post-Installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Type: Expansion anchors.
   2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
   3. For Postinstalled Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
   4. For Postinstalled Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.11 EMBEDDED FLASHING MATERIALS:

A. Flexible Flashing: Provide specified copper-fabric or stainless steel fabric flashing for through-wall applications. Use only where flashing is fully concealed in masonry.

1. Copper-Fabric Flashing:

a. Acceptable Products; subject to compliance with specified requirements, provide one of the following:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) Hohmann and Barnard, Inc.; Copper Fabric NA Flashing.
3) York Manufacturing, Inc.; Multi-Flash 500 Copper Fabric Flashing.

b. Characteristics:

1) Material: Copper sheet bonded between two layers of woven glass fiber fabric embeded in non-asphaltic adhesive polymer compound.
2) Copper weight: Minimum 5-oz./sq. ft.

2. Stainless Steel Fabric Flashing:

a. Acceptable Products; subject to compliance with specified requirements, provide one of the following:

1) Hohmann and Barnard, Inc.; Mighty-Flash.
2) TK Products / Sierra Company, LLC; TWF-18 Stainless Steel Thru-Wall Flashing.
3) York Manufacturing, Inc.; Multi-Flash SS.

b. Characteristics:

1) Material: Type 304 stainless steel sheet meeting ASTM A 167 laminated on one side with layer of polymeric fabric using non-asphaltic adhesive.
2) Properties:

a) Puncture Resistance: 2500 lbs., minimum, when tested per ASTM E 154.
b) Tensile Strength: 90,000 psi, minimum, when tested per ASTM D 412.
c) Mold Resistance: No mold growth when tested per ASTM D 3273.

B. Lap and Bonding Adhesives: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

C. Flashing Cement: Meeting ASTM D 2822-05, Type I.

D. Metal Drip Edge Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual Division 7 Section "Sheet Metal Flashing and Trim", compatible with through-wall flashing and as specified.

1. Sheet Metal Materials: Provide either copper or stainless steel as specified.

a. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight {0.0216 inch thick}; or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight {0.0162 inch thick}.

b. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.

2. Fabrication: Fabricate continuous flashings in sections 8-feet (96-inches) long minimum, but not exceeding 12-feet (144-inches). Provide splice plates at joints of formed, smooth metal flashing.

a. Metal Drip Edges: Fabricate from specified sheet metal compatible with through wall flashing material. Fabricate to extend at least 3-inches into wall and 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.

b. Metal Drip Edges with Sealant Stops: Fabricate from specified sheet metal compatible with through wall flashing material where required for sealant installation. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 3/8-inch to form a stop for retaining sealant backer rod.

E. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Termination Bars: Stainless steel or plastic bars with integral formed sealant lip, 1-inch width by 1/8-inch thickness approximate size; pre-drilled to accept screw fasteners.

2.12 WEEP AND DRAINAGE MATERIALS:

A. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4-inches long.

B. Cavity Drainage Material:

1. Acceptable Products; subject to compliance with specified requirements:

a. Advanced Building Products Inc.; Mortar Break.

b. Mortar Net USA, Ltd.; Mortar Net.

c. Sandell Manufacturing Co., Inc.; Mortar Web.

2. Type: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity; either configuration as specified below.

a. Strips, full-depth of cavity by 10-inches width, with dovetail shaped notches 7-inches deep that prevent mesh from being clogged with mortar droppings.

b. Strips, not less than 3/4-inch thick and 10-inches width, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.

2.13 MISCELLANEOUS MASONRY ACCESSORIES:

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35-percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Rubber Control Joints:

1. Acceptable Products:
   a. Hohmann & Barnard, Inc., RS Series Rubber Control Joint.
   b. Sandell Manufacturing Co., Inc.; Sandell's Rubber Control Joint.
   c. Wirebond / Masonry Reinforcing Corp. of America, 2900 Series Rubber Control Joint.
2. Characteristics:
   a. Type: Extruded rubber, meeting ASTM D2000-90, Designation M2AA-805, minimum 80 durometer hardness.
   b. Size: Manufacturer's standard sizes to fit concrete masonry unit wall widths with allowance for sealant installation.

C. Wire Mesh Hardware Cloth: 1/2-inch by 16-gauge galvanized steel mesh, 2-inches less than wall width; length as required.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.14 MASONRY CLEANING COMPOUNDS AND SEALERS:

A. Brick Cleaning Compound:

1. Acceptable Manufacturers; subject to compliance to specified requirements:
   a. Diedrich Technologies, Inc.
   b. EaCo Chem, Inc.
   c. ProSoCo, Inc.
2. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces.
   a. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   b. Masonry cleaning compound shall be acceptable to brick masonry unit manufacturer and as recommended for specified materials.

2.15 MORTAR AND GROUT MIXES:

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide mortar portioned as specified.

1. Masonry Cement Mortar: One part Type 'S' masonry cement to aggregate proportioned not less than 2¼ nor more than three times the volume of masonry cement used to produce Type 'S' mortar.

2. Cement-Lime Mortar: One part Portland cement and ¼ to ½ parts hydrated lime to aggregate proportioned at no less than 2¼ nor more than three times the combined volume of cement and lime used to produce Type 'S' mortar.
3. Colored Masonry Cement Mortar: One part packaged Type S masonry cement to aggregate proportioned not less than 2¼ nor more than three times the volume of masonry cement used, and as directed by masonry cement manufacturer's product data to produce Type S mortar.

C. Mortar Placement Requirements:

1. For masonry below grade, in contact with earth and where indicated: Type 'S', natural color.
2. For all clay masonry unit (brick) veneer walls: Type 'S', colored mortar as selected by Architect.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type (coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

2.16 SOURCE QUALITY CONTROL:

A. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units are to have been tested according to ASTM C 140 by manufacturer. Submit results of manufacturer's testing at the beginning of the project.

B. Brick Tests: For each type and grade of brick indicated, units are to have been tested according to ASTM C 67 by manufacturer. Submit results of manufacturer's testing at the beginning of the project.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL:

A. Thickness: Build cavity walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 CONSTRUCTION TOLERANCES:

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2-inch or minus 1/4-inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2-inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.

7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16-inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS:

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Patterns:

1. For Exposed Brick Masonry: Lay exposed masonry in running bond, unless otherwise indicated; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
2. Concealed Masonry: Lay masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 8-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between non-rated hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. In-Progress Cleaning:

1. Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
2. surfaces.
3. Remove excess mortar and dust from brick surfaces using medium-soft bristle or fiber brush. Avoid any motion that will result in rubbing or pressing mortar into brick faces.

3.5 MORTAR BEDDING AND JOINTING:

A. Lay solid masonry units, including brick and hollow brick units, with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

B. Mortar Joint Thickness: Lay masonry with 3/8-inch nominal thickness for both horizontal and vertical mortar joints, unless otherwise indicated. Keep bed and head joints uniform in width, except for minor variations required to maintain bond and locate returns

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

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

3.6 CAVITY WALLS:

A. Construct cavity walls with veneer wythe anchored as follows and complying with specified requirements for anchoring masonry veneers.

1. Anchor to masonry back-up wythe using specified masonry joint reinforcement with adjustable ties installed in horizontal mortar joints.
2. Anchor masonry veneer wythe supported by metal framed wall construction using adjustable veneer anchor and tie assemblies as specified.

B. Keep cavities clean of mortar droppings and other materials during construction.

1. Bevel beds away from cavity, to minimize mortar protrusions into cavity.
2. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 7 Section "Fluid-Applied Membrane Air Barriers."

D. Install cavity-wall insulation in according to Division 7 Section "Thermal Insulation."

3.7 ANCHORING MASONRY VENEERS:

A. Masonry Back-Up Construction: Install pintle wall ties to eye sections of joint reinforcement laid in masonry construction and embed in bed joint of masonry veneer wythe as work progresses. Maximum misalignment of bed joints between masonry wythe for tie placement shall not exceed manufacturer's recommended spacing.

B. Metal Stud Back-Up Construction: Anchor masonry veneers to wall framing backup with masonry-veneer anchors to comply with the following requirements:

1. Screw-attach anchors through insulation and sheathing to wall framing with specified metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2-inches of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16-inches on center, vertically, and 24-inches on center, horizontally, with not less than 1 anchor for each 2-sq. ft. of wall area.
    a. Install additional anchors within 12-inches of openings and at intervals, not exceeding 8-inches, around perimeter.
    b. Install additional ties at each side of masonry expansion control joints, within 8-inches of joint, in addition to spacings specified.
    c. Install additional ties at each side of building expansion joints located in masonry walls, within 8-inches of joint, in addition to spacings specified.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS:

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1/2 inch 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

B. Weld-On Beam Anchors: Weld beam anchor rod tie receptors to steel beams adjacent to masonry veneer wythe at 32-inches (2'-8") maximum horizontal centers. Install wire ties to anchor rod receptors and set in mortar bed as masonry is laid.

C. Weld-On Column Anchors: Install column anchors at locations indicated. Weld anchor rod tie receptors to steel columns spaced at 16-inches (1-4") vertical centers and aligned with masonry joints. Insert ties to anchor rod receptors and set in mortar bed as masonry is laid.

3.9 CONTROL AND EXPANSION JOINTS:

A. Install control joint materials in unit masonry where indicated on the Drawings. If not indicated, spacing shall not exceed industry standard. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Control Joints in Concrete Masonry Unit Construction:

1. Make joint 3/8-inch wide, unless otherwise indicated. Construct joints straight, plumb and vertical.
2. Where control joints occur in running walls, provide sash block with rubber control joint filler. Build in control joint fillers installed in masonry as work progresses. At exposed locations, recess face of fillers 3/8-inch from finished masonry surface for application of sealant.
3. Provide masonry control joints at locations indicated on drawings, but at not less than the following locations:
   a. In running walls spaced maximum 35-ft. on center.
   b. At intersecting walls, either of which is more than 10-ft. long.
   c. At structural columns.
   d. At joint between masonry and structural slabs beams or decks.
   e. At all changes in wall thickness.
   f. At all abrupt changes in wall height.
4. Where control joints are not indicated on Contract Drawings, locations shall be in accord with final reviewed and accepted shop drawings, complying with specified requirements indicated above.
5. Leave joint open and clean for installation of sealant and backer rod in accord with Division 7 Section "Joint Sealants." Caulk joints exterior and interior with specified sealant material.

C. Brick Expansion Control Joints: Install expansion control joint and pressure relieving joint materials in brick masonry construction as work progresses. Place expansion control joints at locations indicated on Drawings, or if not indicated, not more than 25'-0" on center.

1. Do not allow materials to span expansion control joints without provision to allow for in-plane wall or partition movement.
2. Construct 1/2-inch wide open vertical joints in veneer wythe to allow for movement; unless otherwise indicated.
   a. Construct vertical joints straight and plumb; horizontal joints level and true to line.
   b. Provide temporary spacers to construct joints to prevent mortar and debris from entering joints, except where a filler material is to be inserted into the joints such a backer rod for sealant application.
   c. Remove spacers and clean joint surfaces when ready for sealant installation.
3. Keep joints free of mortar and debris.
4. Caulk control joints using specified sealant.
   a. Install sealant and backer rod specified in Division 7 Section "Joint Sealants."
   b. Joints shall be watertight after caulking.

D. Provide horizontal, pressure-relieving joints where indicated. Construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."

E. Building Expansion Joints in Masonry Walls:

1. Construct joints to widths indicated, straight, plumb and vertical.
2. Stop joint reinforcement in masonry back-up wythe 1-inch from each side of expansion joint. Locate veneer ties on each side of joint as specified.
3. Keep joint clear of mortar as wall is laid.
4. Leave joint open and clean for installation of sealant system as specified in Division 7 Section "Joint Sealants."

3.10 LINTELS:

A. Steel Lintels: Install steel lintels where indicated.

B. Masonry Lintels: Install masonry lintels where shown and where openings of more than 8-inches for block-size units and more than 6-inches for brick-size units are shown without structural steel or other supporting lintels.

1. Construct built-in-place masonry lintels using specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.
2. See structural drawings for lintel reinforcing.

C. Provide minimum bearing of 8-inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS:

A. Install embedded through-wall flashing and weep holes in masonry at lintels, shelf angles, ledges, head and sills of exterior masonry openings, at base of wall along floor line just above finish grade and other obstructions to direct flow of water out of wall cavities, and where indicated.

B. Provide through flashing in sufficient widths for installation through wall construction as specified, terminating within 1/2-inch of face of exterior masonry wythe and to lap over drip edge flashing.

C. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

D. Install flashing as follows, unless otherwise indicated:

1. At multiwythe masonry walls, including cavity walls, place flashing located 1/2-inch from outside face of exterior veneer wythe lapped and sealed over metal drip edge flashing, extending through wall into cavity or collar joints and turned up a minimum of 8-inches against face of inner wythe and 1-1/2 inches into the mortar bed joint of inner wythe.
2. At masonry-veneer walls with framed stud back-up construction, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8-inches; with upper edge secured in place using continuous termination bar screw-attached through sheathing into each metal studs. Seal top edge with continuous

sealant bead or self-adhering flashing strip as specified in Division 7 Section " Fluid-Applied Membrane Air Barriers."

3. At lintels and shelf angles, extend flashing a minimum of 6-inches into masonry at each end.
4. At heads and sills, extend flashing 6-inches at ends and turn up not less than 2-inches to form end dams.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

E. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

F. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent tubing material to form weep holes.
2. Space weep holes formed from plastic tubing at 16-inches (1'-4") on center.
3. Install weep tubing flush with outside face of masonry; trim projections if required after mortar has set.

G. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material specified.

1. Install cavity drainage material continuous at weep and through-wall flashing locations along base of wall just above grade, at lintels over wall openings and at shelf angles of masonry cavity wall construction.
2. Place drainage net in continuous row snug in cavities direct over through-wall flashing at specified locations. Install material to fit between interior face of outer masonry wythe and cavity wall insulation or inner masonry wythe where insulation is not installed.
3. Coordinate placement with weep installation to maintain adequate drainage of cavities.

3.12 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform specified field tests and inspections and prepare test reports.

1. Notify Owner, inspectors and testing agency in advance of when masonry construction will begin.
2. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections.
3. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections:

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Required Tests:

1. Mortar Testing: Mortar properties will be tested per ASTM C 780.
2. Grout Testing: Grout will be sampled and tested for compressive strength per ASTM C 1019.
3. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

3.13 REPAIRING AND POINTING:

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.14 FINAL CLEANING:

A. After mortar is thoroughly set and cured, clean exposed concrete unit masonry, architectural ground face concrete unit masonry and brick masonry as specified.

B. Brick Masonry Walls:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on a sample wall panel at least 21 day in advance of performing cleaning operation.
    a. Should discoloration of masonry or mortar joints, staining or efflorescence appear on sample panel area notify Architect and await further instructions.
    b. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with specified masonry cleaning compound applied according to manufacturer's written instructions. Apply cleaning compound to masonry and flush with clean water.

a. Do not perform wet cleaning within seven days of placing masonry.

b. At least two hours prior to application of cleaning solution to masonry work, saturate mortar joints with clean water and flush off loose debris.

c. Thoroughly wet walls before applying cleaning solution and thoroughly rinse walls afterward.

d. Begin cleaning process at highest point of wall, working downward. Work in areas of 20 square feet maximum. Flush wall as cleaning progresses to prevent accumulation of scum.

e. Discard solutions containing debris and residue so not to contaminate adjacent areas.

f. Do not use high pressure to apply cleaning solution. Do not scrub mortar joints with cleaning solution.

g. Rinse masonry and surrounding surfaces immediately after cleaning with clear water.

6. Remove stains on brick masonry surfaces according with recommendations of the Brick Institute of America, "Technical Notes No. 20," dated June 2006. Apply cleaning agents only after testing on sample panel area.

3.15 MASONRY WASTE DISPOSAL:

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."

3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 044313

ADHERED MASONRY VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thin brick veneer.

1.2 RELATED SECTIONS

A. Section 042000 – Unit Masonry

1.3 REFERENCES

A. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's catalog data, detail sheets, and printed installation instructions.

C. Selection Samples: For each product requiring color/texture selection, provide full size samples for final selection.

D. Verification Samples: For each product, color, and texture selected, provide two full-size units representing actual color and texture of products to be installed.

1.5 SAMPLE PANELS

A. Construct sample panel at location indicated or directed, and as follows:
1. Size: 4 feet by 4 feet (1.2 m by 1.2 m).
2. Include all unit types and sizes to be used, and mortar joint treatment.

B. Obtain architect's acceptance of sample panel before beginning construction activities of this section.

C. Do not remove sample panel until construction activities of this section have been accepted by architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products of this section on pallets, with individual faces protected; keep dry.

B. Store units in protected area or under cover on level ground; keep dry. Do not double-stack pallets.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cherokee Brick

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

C. Substitutions: Not permitted.

2.2 MATERIALS

A. Thin Brick: ASTM C 1088, Type TBX, tested in accordance with ASTM C 67, as manufactured by Endicott Clay Products Co.
   1. Size: 2-1/4 inches (57.2 mm) high, 7-5/8 inches (193.7 mm) long, 1/2 inch (12.7 mm) thick.
   2. Texture: Smooth.
   3. Texture: Wirecut.
   4. Texture: Sand Finish.
   5. Color: Georgia Heritage – Old Savannah

B. Trim Units: Matching thin brick.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install thin brick in accordance with manufacturer's printed instructions, approved submittals and in proper relationship with adjacent construction.

END OF SECTION 044313

SECTION 051200 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Description:

1. This section includes elements of the structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
2. This section does not include Miscellaneous Metal Fabrications.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Structural Steel work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of AISC 360 “Specification for Structural Steel Buildings”, RCSC “Specification for Structural Joints Using High-Strength Bolts”, and AISC303 “Code of Standard Practice for Steel Buildings and Bridges” in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.
2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172)..

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

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

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of the following connections required by the Construction Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a registered design professional licensed in the state in which the project is located, to withstand loads indicated and comply with other information and restrictions indicated.

1. Simple Shear Connections: Connections shall be selected or completed by an experienced steel detailer. Tables in the AISC Steel Construction Manual shall be used.
2. Connections other than Simple Shear Connections: Connections shall be designed by a registered design professional licensed in the state in which the project is located working for the fabricator.
3. Use ASD; data are given at service-load level.
4. Where beam shear is not noted, the connections shall develop the beam shear V = W/2 where W is the total allowable beam uniform load based on laterally supported simple span moments per tables located in the AISC Steel Construction Manual.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Slide bearings.
8. Prefabricated building columns.
9. Shop primer.
10. Galvanized-steel primer.
11. Etching cleaner.
12. Galvanized repair paint.
13. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.
9. Structural Steel Connections:

a. Simple Shear Connections: Include substantiating connection information documenting the shear capacity of a minimum of (3) representative connection types on the project.
b. Connections other than Simple Shear Connections: Include calculations signed and sealed by the registered design professional licensed in the state where the project is located, who is responsible for their preparation. Additionally, the registered design professional in responsible charge of the connection design shall review and confirm in writing that the approval documents properly incorporate the connection designs.

1.6 INFORMATION SUBMITTALS

A. Qualification Data: For qualified Installer and Fabricator.

B. Welding certificates.

C. Material (Mill) test reports for structural steel, including chemical and physical properties.

D. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Steel headed stud anchors (shear connectors/shear studs).
5. Shop primers.

E. Source quality-control reports.

F. Survey of existing conditions.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting fasteners after lubrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

C. All Structural Steel not receiving fire-proofing shall receive one shop coat of rust-inhibitive primer. All steel with exterior exposure shall be painted with a double coat of rust prohibitive epoxy primer (material and thickness to be specified by Architect) unless noted as galvanized or architecturally exposed structural steel.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Provide Structural Steel materials meeting the standards and grades set forth in the Construction Drawings.

2.2 BOLTS, CONNECTORS, AND ANCHOR RODS

A. Provide Bolts, Connectors, and Anchors of materials meeting the standards and grades set forth in the Construction Drawings.

2.3 SHRINKAGE-RESSISTANT GROUT

A. Provide shrinkage-resistant grout materials meeting the standards and grades set forth in the Construction Drawings.

2.4 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermally cut, or punch holes perpendicular to steel surfaces. Do not free-hand thermally cut bolt holes or enlarge holes by burning.

D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members only as indicated in Structural Construction Drawings.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not free-hand thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.6 PRIMER PAINT

A. Fabricator’s standard rust-inhibiting grey primer. Do not prime steel that is to receive fire-proofing spray. Provide finish where indicated on Construction Drawings (see Architectural Drawings and Division 09 specifications).

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to Structural Steel according to ASTM A123.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles, any framing exposed to earth or weather, and other framing as indicated in the Construction Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with Steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep Structural Steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent Structural Steel, connections, bracing, and diaphragms are in place unless otherwise indicated.

3.3 ERECTION

A. Set Structural Steel accurately in locations and to elevations indicated and in accordance with AISC 303 and AISC 360.

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate where indicated in Structural Construction Drawings.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of Structural Steel within AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Construction Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 054000 – COLD FORMED STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior non-load-bearing wall framing
   2. Roof rafter framing
   3. Ceiling joist framing.

B. Related Documents and Standards:

   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and the requirements of AISI S100 “North American Specification for the Design of Cold-formed Steel Structural Members”, AISI S240 “North American Standard for Cold-formed Steel Structural Framing”, and AISI S202 “Code of Standard Practice for Cold-formed Steel Structural Framing” in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:

   1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on Construction Drawings and/or Shop Drawings.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code–Steel,” and AWS D1.3, “Structural Welding Code–Sheet Steel.”

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory indicated.

B. Shop Drawings: Submit Shop Drawings showing fabrication and erection procedures. Shop Drawing (if indicated as a requirement by this specification) shall bear the seal of a registered design professional licensed in the state in which the project is located.

1. Show locations, sizes, gauges, spacing and types of framing composites, details of connections and framing of windows, doors and punched openings.
2. Indicate all prefabricated framing with individual panels shown for each condition. Indicate member properties, details of connections, all erection and permanent bracing required.
3. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for installation.
4. Shop Drawings shall indicate sequence and method of erection details of all connection of cold-formed steel framing to other elements of the building structure.
5. Indicate shop and field assembly details, including cut and connections.
6. Indicate type and location of welds, bolts, and fastening devices.

C. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

D. Structural design calculations: Indicate compliance with specified design criteria. Calculations shall bear the seal of a registered design professional licensed in the state in which the project is located.

1.5 INFORMATION SUBMITTALS

A. Welding certificates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed steel framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing that may be incorporated into the Work include, but are not limited to, the following:

1. Clark Dietrich Building Systems

2. Marino\Ware
3. Cemco Steel

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ a qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.

1. Design Loads: As indicated in the Construction Documents.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Wall Framing: Horizontal deflection of L/600 for brick/stone veneer, L/360 for simulated stone walls or stucco finish and L/240 for EIFS or other flexible finishes.
   b. Roof Rafter Framing: Vertical deflection of [**1/240**] of the horizontally projected span.
   c. Ceiling Joist Framing: Vertical deflection of [**1/240**] of the span.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as indicated in the Construction Documents.
4. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. In addition to design loads all cold-formed members shall be sized for the connection requirements of the cladding and/or framing which attaches to them, including but not limited to sheathing, paneling, doors, windows, louvers, minor canopies, and sun shades.

D. Existing Conditions: Inspect structure for compliance with specified erection tolerances.

E. Design and coordinate installation and location of anchors and inserts with structural system to which cold-formed steel framing is attached.

2.3 MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, minimum 20 gauge, metallic coated, of grade and coating designation as follows:

1. Grade:

   a. ST33H for 33 mil and 43 mil
   b. ST50H for 54 mil, 68 mil, and 97 mil

2. Coating:

   a. G60.

B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: Not less than coating of connected element.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

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

1. Minimum Base-Metal Thickness: 1-5/8 inch.
2. Flange Width: 1-3/8 inches.

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

1. Minimum Base-Metal Thickness: Matching steel studs.

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

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

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

F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure.
2. Inner Track: Of web depth indicated.

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

2.5 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel joists, unpunched and without splices.

2.6 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel joists, unpunched and without splices.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

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

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

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

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

C. Welding Electrodes: Comply with AWS standards.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true-to-line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, or screw fastening, according to Shop Drawings and manufacturer's requirements.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true-to-line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/4 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances in AISI S202 and other conditions affecting performance.

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

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S202, and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true-to-line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Handling and lifting of prefabricated panels or assemblies shall be done in a manner as to not cause distortion or damage in any member, or damage to any connection.

H. Loads placed on panels or assemblies during erection shall not exceed design loads.

I. Do not bridge building expansion and control joints with cold-formed steel framing. Independently frame both sides of joints.

J. If required, install insulation, specified in Division 07, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

K. Erection Tolerances: Install cold-formed steel framing level, plumb, and true-to-line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/4 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated or as required by design.

1. Anchor Spacing: As required by design, but not to exceed 24 inches max, and within 3 inches of ends.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/4 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated or as required by design.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. In high seismic areas connect drift clips to cold formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Decrease spacing as required by design. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track, or install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

1. Install solid blocking at 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF JOIST FRAMING

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

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with required end bearing.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: as indicated or as required by design.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals as indicated or as required by design. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 054400 – COLD FORMED STEEL TRUSSES

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. Description:

1. This section includes Pre-Engineered Cold-Formed Steel Trusses consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site. Work may be referred to on the Construction Documents as Pre-Engineered Cold-Formed Steel Trusses.
2. Types of prefabricated trusses include:

a. Gable-shaped trusses.
b. Monopitch trusses.
c. Irregular shaped trusses.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and where required shall be designed in accord with AISI “Cold Formed Steel Design Manual”.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on drawings and/or shop drawings.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

C. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code–Steel,” and AWS D1.3, “Structural Welding Code–Sheet Steel.”

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

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

E. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully fabricated trussed assemblies similar to scope required and which practices a quality control program which includes inspection by an independent inspection and testing agency acceptable to Architect and authorities having jurisdiction

1.4 SUBMITTALS

A. Product Data: For each type of truss product and components and accessories indicated.

B. Shop Drawings: Submit shop drawings showing fabrication and erection procedures. Shop drawings shall bear the seal of a registered design professional licensed in the state in which the project is located.

1. Show locations, sizes, gage, and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation. Shop drawings shall include all placement sequences and instructions.
2. Shop drawings shall indicate sequence and method of erection details of all connection of trusses to other elements of the building structure.

C. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

D. Welding certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store truss materials and accessories in accordance with manufacturer's instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure. Storage shall be off-ground in a dry ventilated space or protect with waterproof coverings.

B. Time fabrication and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide trusses capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.

1. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:

a. Scissor Roof Trusses: Horizontal deflection of **[1/360**] of the horizontally projected span.
b. Roof Trusses: Vertical deflection of **[1/240**] of the span.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions."

1. Roof Trusses: Design according to AISI's "Standard for Cold-Formed Steel Framing - Truss Design.

D. In addition to design loads all cold formed members shall be sized for the connection requirements of the sheathing and/or framing which attaches to them, including but not limited to sheathing, paneling, and suspended equipment.

E. Existing conditions: Inspect structure for compliance with specified erection tolerances.

F. Design and coordinate installation and location of anchors and inserts with structural system to which trusses are attached.

PART 2 - PRODUCTS

2.1 FRAMING COMPONENT MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing components that may be incorporated into the Work include, but are not limited to, the following:

1. All-Span, Inc
2. Alpine TrusSteel
3. Clark Dietrich Building Systems
4. Cemco Steel
5. Marino\Ware

2.2 MATERIALS

A. Galvanized steel meeting ASTM A1003, designation G60, minimum 20 gauge, and minimum 16 gauge for members being welded to structure. Connector plates and connection anchors shall be G90 minimum.

2.3 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard-shape steel sections.

2.4 FRAMING ACCESSORIES

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

1. Bracing, bridging, and solid blocking.
2. Web stiffeners.
3. Anchor clips.
4. End clips.
5. Gusset plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 4 times design load.

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

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

C. Welding Electrodes: Comply with AWS standards.

2.6 FABRICATION

A. Fabricate trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this section.

1. Fabricate truss assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten truss component members by welding or screws.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Provide all angles, clips, and other miscellaneous pieces necessary to attach trusses to building structure or to attach accessories to trusses.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

A. Pre-engineered cold-formed steel trussed frames shall be fabricated either on or off site prior to erection.

3.3 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: as indicated or as required by design.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.

E. Erect trusses without damaging framing members or connections.

F. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA's Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed trusses with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400

SECTION 055000 – METAL FABRICATIONS

Commented [TJS1]: Coordinate with project specification numbering format.

Commented [TJS2]: PLEASE NOTE, PES METAL FABRICATION SPEC DOES NOT HAVE LADDER SECTION. IF REQUIRED THIS SHOULD BE COORDINATED BY ARCHITECT.

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. Description:

1. This section includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Related Documents and Standards:

1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
2. All Metal Fabrication work on this project shall confirm to the Construction Documents and applicable building code including referenced standards.

C. Related Sections:

1. Division 05 Specifications – Steel Construction.
2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

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

B. Field Measurements: Verify actual locations of walls and other construction contiguous with Metal Fabrications by field measurements before fabrication.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for Metal Fabrications.

1. Include plans, elevations, sections, and details of Metal Fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For Metal Fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 METAL MATERIALS

A. Provide Structural Steel materials meeting the standards and grades set forth in the Construction Drawings.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. Provide Bolts, Connectors, and Anchors materials meeting the standards and grades set forth in the Construction Drawings.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

2.8 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe or as indicated in Architectural Drawings.

1. Cap bollards with 1/4-inch thick steel plate when not filled with concrete.
2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
4. See Architectural Drawings for requirements.

B. Coordinate bollard attachment (base plate or embedment) with Architectural Drawings.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete where indicated on Architectural Drawings.

B. Anchor bollards as indicated in Architectural Drawings.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

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

END OF SECTION 055000

Commented [TJS3]: Coordinate with project specification numbering format.

SECTION 064000

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. Section Includes:
1. Plastic-laminate cabinets.
2. Plastic-laminate countertops
3. Solid-surfacing fabrications including the following:
   a. Countertops.
   b. Countertops with integral lavatory bowls.
   c. Window stools.
   d. Lavatory bowls for integral mounting to quartz surface countertops.
4. Quartz surfacing fabrications including the following:
   a. Countertops.
   b. Countertops with integral solid surface lavatory bowls.
5. Shop finishing of interior woodwork.

B. Extent of each type of architectural woodwork is indicated on drawings and in schedules.

C. Related work specified elsewhere includes:

1. Division 5 Section - "Metal Fabrications."
2. Division 6 Section – "Rough Carpentry."
3. Division 7 Section – "Joint Sealants."
4. Division 8 Section – "Door Hardware."
5. Division 9 Section – "Painting."

1.3 SUBMITTALS:

A. Product Data:

1. Submit for panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, quartz surfacing material, cabinet hardware and accessories, finishing materials and processes.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

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

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including

concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples:
1. Lumber for Transparent Finish: Submit not less than 50 sq. in. for each species and cut, finished on one side and one edge.
2. Veneer-Faced Panel Products for Transparent Finish: Submit 12-inches by 24-inches sample panel, for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Plastic Laminates: Submit manufacturer's standard samples, approximately 3-inches by 3-inches for each type, color, pattern, and surface finish as required for this project, and representative color range anticipated.
4. Solid-Surfacing Materials: Submit 6 inches square sample for each type, color, pattern, and finish as required for this project.
5. Quartz Surfacing Materials: Submit 6 inches square sample for each type, color, pattern, and finish as required for this project
6. Exposed Cabinet Hardware: Submit one unit of each type and finish, which will be returned for use on the project, upon request by the Contractor

D. Qualification Data: Submit for installer and fabricator to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE:

A. Fabricator Qualifications: Fabricators shall be experienced firms specializing in the types of architectural woodwork, including solid surfacing fabrication work, required for this project for at least the past 5-verifiable years and on at least 10-verifiable projects of similar size, scope, complexity, and quality as this project.

1. Prequalification is required.
2. Fabricator shall also be certified or approved by solid surfacing and quartz surfacing material manufacturers to fabricate work using specified materials.

B. Installer Qualifications: Arrange for installation of architectural woodwork by the fabricator, or by a firm under the control and direction of the fabricator, which can demonstrate at least 5-verifiable years successful experience in installing architectural woodwork items on at least 5-verifiable projects, similar in type and quality to those required for this project.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of architectural woodwork indicated for construction, finishes, installation, and other requirements.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Construct mock-up of the following indicating construction and finish required to verify selections made under sample submittals:
   a. Typical plastic-laminate cabinet unit, including countertop.
   b. Typical wood cabinet work.
   c. Standing and running trim.
   d. Wood paneling.
   e. Solid surface fabrications.
   f. Quartz surface fabrications.
2. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be fabricated and installed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting fabrication.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soilage and deterioration.

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

1.6 PROJECT CONDITIONS:

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining

temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION:

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

B. Coordinate fabrication and installation requirements of plumbing fixtures, trim and toilet accessories required to be mounted to countertops.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS:

A. Acceptable Fabricators; subject to compliance with specified requirements:

1. Artisan Millwork, LLC.
2. Cabinets by Design, Inc.
3. Commercial Cabinetry of Georgia, LLC.
4. Commercial & Custom Cabinets, Inc.
5. Leeman Architectural Woodwork.
6. Pierce & Pierce.
7. Mortensen Woodwork, Inc.
8. Royal Custom Cabinets, Inc.
9. Willingham Sash and Door Company.

2.2 MATERIALS:

A. Material Quality: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: Red Oak, plain sawn or sliced.

C. Wood Species for Opaque Finish: Eastern white pine, sugar pine, or western white pine.

D. Wood Products: Complying with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue; made with binder containing no urea formaldehyde.
4. Softwood Plywood: DOC PS 1.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

E. High-Pressure Decorative Laminate:

1. Acceptable Manufacturers; subject to compliance with specified requirements:
   a. Formica Corporation.
   b. Lamin-Art, Inc.
   c. Nevamar Company, LLC; Decorative Products Div.
   d. Panolam Industries International Incorporated.
   e. Wilsonart International; Div. of Premark International, Inc.
2. Type: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   a. Grade HGS: 0.048-inch nominal thickness.
   b. Grade VGS: 0.028-inch nominal thickness.
   c. Grade HGP 0.039-inch nominal thickness.
   d. Grade VGP 0.028-inch nominal thickness.
   e. Grade CLS: 0.020-inch nominal thickness.
   f. Grade BKL: 0.020-inch nominal thickness.
3. Colors and Patterns: As selected by Architect from manufacturer's full range selection, unless otherwise scheduled on drawings.

F. Low-Pressure Decorative Laminate (LPDL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

G. Solid-Surfacing Material:

1. Acceptable Products; subject to compliance with specified requirements: As indicated or scheduled on Drawings.
2. Material: Cast or molded, homogeneous, non-porous, filled acrylic polymer resin with fillers and pigments; complying with ISFA 2-01 (2013).
   a. Type: Standard type, unless Special Purpose type is indicated.
   b. Flammability:: Meeting Class A (Class I) surface-burning characteristics as determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1) Flame-Spread Index: 25 or less.
      2) Smoke-Developed Index: 450 or less.
   c. Thickness: 1/2-inch (12-mm), minimum.
   d. Colors and Patterns: As selected by Architect from manufacturer's full range selection, unless otherwise scheduled on drawings.

H. Quartz Surfacing:

1. Acceptable Products; subject to compliance with specified requirements: As indicated or scheduled on Drawings.

2. Material: Homogeneous solid sheets of natural quartz fillers and pigments blended with plastic resins complying with ISFA 3-01 (2013),
   a. Thickness: 3/4-inch (19-mm), minimum.
   b. Colors and Patterns: As selected by Architect from manufacturer's full range selection, unless otherwise scheduled on drawings.

I. Integral Solid Surface Lavatory Bowls and Sinks: Solid Surfacing manufacturer's cast acrylic polymer bowls fabricated for integral seaming to solid polymer countertop materials. Provide for integration to solid surfacing and quartz surfacing countertop fabrications.

1. Type and Sizes: As indicated on Drawings.
2. Color: As selected by Architect from manufacturer's standard colors.

2.3 FIRE-RETARDANT-TREATED MATERIALS:

A. Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Interior Type A: Low-hygroscopic formulation.
2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
3. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard:

1. Acceptable Product; subject to compliance with specified requirements: Weyerhaeuser Company; Duraflake FR.
2. Characteristics: Particleboard panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84 and complying with the following requirements:

a. For panels 3/4-inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties:
   1) Modulus of rupture: 1600 psi .
   2) Modulus of elasticity: 300,000 psi.
   3) Linear Expansion: 0.35-percent.
   4) Internal bond: 80 psi.
   5) Screw-holding capacity on face and edge: 250 and 225 lbf, respectively.

b. For panels 13/16 to 1-1/4 inch thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties:
   1) Modulus of rupture: 1300 psi.
   2) Modulus of elasticity: 250,000 psi.
   3) Linear Expansion: 0.50 percent.
   4) Screw-holding capacity on face and edge: 250 and 175 lbf, respectively."

D. Fire-Retardant Medium-Density Fiberboard:

1. Acceptable Product; subject to compliance with specified requirements: SierraPine Ltd.; Medite FR.

2. Characteristics: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.4 CABINET HARDWARE AND ACCESSORIES:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening**,** self-closing.

C. Wire Pulls: Back mounted, solid metal, 4-inches long, 5/16-inch diameter; satin stainless steel.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Drawer Slides: BHMA A156.9, B05091.

1. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted; full-extension type; zinc-plated steel with polymer rollers.

2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

3. Types:
   a. Box Drawer Slides: Grade 1; for drawers not more than 6-inches high and 24-inches wide.
   b. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches

high or 24-inches wide.

c. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24-inches wide.

F. Cabinet Locks:

1. Door Locks: BHMA A156.11, E07121.

2. Drawer Locks: BHMA A156.11, E07041.

G. Grommets for Cable Passage through Countertops:

1. Acceptable Product; subject to compliance with requirements: Doug Mockett & Company, Inc.; SG series.

2. Characteristics: 2-inch outside diameter, black molded-plastic grommets and matching plastic caps with slot for wire passage.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS:

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Nails and Brads: ASTM F 1667; select material, type, size, and finish required for each use

D. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements. For metal framing supports, provide screws as recommended by metal-framing manufacturer.

E. Adhesives: Types as recommended by fabricator that do not contain urea formaldehyde. Use installation adhesives and glues that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

F. Solid Surfacing/Quartz Surfacing Adhesives and Sealant:

1. Joint Adhesive: Surfacing material manufacturer's standard two-part adhesive. Adhesive shall be type to create inconspicuous, non-porous joints and blend in with solid surfacing material.
2. Panel Adhesive: Surfacing material manufacturer's standard neoprene-based adhesive meeting ANSI A136.1; UL Listed.
3. Sealant: FDA approved, mildew-resistant silicone sealant in colors matching components and acceptable to surfacing material manufacturer.

2.6 FABRICATION, GENERAL:

A. Interior Woodwork Grade: Complying with the referenced quality standard as specified below unless otherwise indicated.

1. Wood Millwork and Paneling: AWI Premium Grade.
2. Wood Casework: AWI Premium Grade.
3. Plastic Laminate Work: AWI Custom Grade.
4. Solid surfacing and Quartz Surfacing Fabrications: AWI Premium Grade.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to 1/16 inch radius.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
2. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
3. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

1. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of openings in countertops with a coat of varnish.

2.7 WOOD PANELING FOR TRANSPARENT FINISH:

A. AWI Grade: Premium.

B. Wood Species and Cut: Red Oak, plain sliced.

C. Lumber Trim and Edges: At the fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.

D. Matching of Adjacent Veneer Leaves: Book match.

E. Veneer Matching within Panel Face: Balance match.

F. Panel-Matching Method: Sequence-matched, uniform-size sets within each separate area.

G. Vertical Panel-Matching Method: Panel vertical book match; panels are book matched from lower panels to upper panels.

H. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 75 or less and smoke-developed index of 450 or less per ASTM E 84.

2.8 PLASTIC-LAMINATE CABINETS:

A. AWI Grade: Custom.

B. AWI Cabinet Construction Type and Style: Type A- frameless construction; Flush Overlay style.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
1. Horizontal Surfaces Other Than Tops: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.

D. Materials for Semi-Exposed Surfaces:
1. Semi-Exposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade CLS, or LPDL panels with PVC or polyester edge banding.
2. Drawer Sides and Backs: Solid-hardwood lumber, or LPDL panels with PVC or polyester edge banding.
3. Drawer Bottoms: Hardwood plywood or LPDL panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

G. Interior Wood Drawer Bodies [If Used]: Semi-exposed portions of cabinetwork not finished with laminate shall receive minimum stain, sealer and top coat according to AWI Section 5 requirements; sanded between coats.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as specified.

2.9 PLASTIC-LAMINATE COUNTERTOPS:

A. AWI Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces as selected by Architect from manufacturer's full range selection unless otherwise indicated on Drawings.

D. Edge Treatment: Same as laminate cladding on horizontal surfaces, unless otherwise indicated on Drawings.

E. Core Material: Medium-density fiberboard.

F. Backer Sheet: Fabricate countertop with plastic-laminate backer sheet, Grade BKL, on underside of core material.

G. Fabricate plastic laminate counter top using specified materials. Bond plastic laminate to substrates with specified adhesives, including laminate backing sheet on unexposed surface.
1. Fabricate countertop in maximum single continuous lengths practicable. Where joining is required use compression type fasteners forming flush, tight, hairline joints.
2. Sand edges of cutouts to remove splinters and burrs.
3. Provide matching back and end splashes for installation to wall surfaces where indicated.

2.10 SOLID-SURFACING FABRICATIONS:

A. AWI Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2-inch (12-mm).

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material as selected by Architect from manufacturer's full range selection unless otherwise indicated on Drawings.

D. Fabricate components with exposed surfaces free of scratches, chips, marks or similar imperfections.

E. Countertops: Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with shop-applied backsplashes or loose backsplashes for field application. Fabricate backsplashes with 1/2-inch radiused cove at intersection with top.
3. Fabricate end and sidesplashes as indicated for field application.

F. Countertops with Integral Bowls: Fabricate countertops with integral solid surface sink bowls installed in shop.

1. Fabricate cut-outs for integral sink or bowl mounting according to solid surfacing manufacturer's instructions. Adhere sink or bowl centered to prepared cut-out in countertop using manufacturer's recommended mounting adhesive.
2. Factory prepare cut-outs for plumbing fittings and accessories as indicated and specified in other sections. Drill holes in countertops for plumbing fittings in shop.

G. Window Stools: Fabricate window stools to sizes and profiles indicated. Rout exposed edges to provide continuous smooth radiused edges unless otherwise indicated.

2.11 QUARTZ SURFACING FABRICATIONS:

A. AWI Grade: Premium.

B. Quartz Surfacing-Material Thickness: 3/4-inch (19-mm).

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of quartz surfacing material as selected by Architect from manufacturer's full range selection unless otherwise indicated on Drawings.

D. Fabricate components with exposed surfaces free of scratches, chips, marks or similar imperfections.

E. Countertops: Fabricate tops in one piece, unless otherwise indicated. Comply with quartz surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with shop-applied backsplashes or loose backsplashes for field application. Fabricate backsplashes with 1/2-inch radiused cove at intersection with top.
3. Fabricate end and sidesplashes as indicated for field application.

F. Countertops with Integral Bowls: Fabricate countertops with integral solid surface sink bowls installed in shop.

1. Fabricate cut-outs for integral sink or bowl mounting according to solid surfacing manufacturer's instructions. Adhere sink or bowl centered to prepared cut-out in countertop using manufacturer's recommended adhesive and mounting hardware.
2. Factory prepare cut-outs for plumbing fittings and accessories as indicated and specified in other sections. Drill holes in countertops for plumbing fittings in shop.

2.12 UTILITY SHELVING:

A. Grade: Custom.

B. Shelf Material: 3/4-inch solid lumber or veneer-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch solid lumber or panel product.

D. Wood Species: Any closed-grain hardwood.

2.13 SHOP FINISHING:

A. Finishing Requirements: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.

B. Grade: Provide finishes of same grades as items to be finished.

C. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 09 painting Sections for material and application requirements.

D. Preparation for Finishing:

1. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

2. Backpriming:
   a. Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork.
   b. Apply two coats to back of paneling and to end-grain surfaces.
   c. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate.

E. Transparent Finish:

1. AWI Grade: Premium.
2. AWI Finish System: System-5, Conversion Varnish.
   a. Staining: Match approved sample for color.
   b. Filled Finish for Open-Grain Woods: After staining, apply paste wood filler to open-grain woods and wipe off excess.
      1) Tint filler to match stained wood.
      2) Apply wash-coat sealer after staining and allow to dry before filling.
3. Sheen: Satin**,** 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION:

A. Grade: Install woodwork to comply with requirements for the same grade specified for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8-inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 8-ft. (96-inches) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
2. Install standing and running trim with no more variation from a straight line than 1/8-inch in 8-ft. (96-inches).

H. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips or other acceptable concealed fastening method indicated on final reviewed shop drawings. Do not use face fastening, unless covered by trim.

1. Install wood paneling in proper sequence and match in accord with final reviewed and accepted shop drawings. Layout panel following numbered sequence indicated on shop drawings.
2. Position, align and attach concealed hanger clips to supports at proper locations for hanging of wood paneling.
3. Install paneling plumb, level and aligned within tolerances complying with specified AWI quality grade standard.
4. Install paneling with no more than 1/16 inch in 96-inch (8-ft.) vertical cup or bow and 1/8 inch in 96-inch (8-ft.) horizontal variation from a true plane.

I. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8-inch in 8-ft. (96-inch) sag, bow, or other

variation from a straight line.

2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16-inches on center. Attach with screws to framing, blocking or metal backing plates as follows:
   a. No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
   b. No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
   c. Toggle bolts through metal backing or metal framing behind wall finish.

J. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8-inch in 8-ft. (96-inch) sag, bow, or other variation from a straight line.
2. For solid-surface and quartz surface countertops, align with adjacent surfacing material of same construction and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
3. Secure backsplashes to tops with adhesive.
4. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants".
5. Leave installed countertops with integral sinks prepared and ready for plumbing connections, and fixture and trim installations, as specified in Division 22 – Plumbing.

K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

L. Refer to Division 9 Section "Painting" for final finishing of installed woodwork specified for opaque finish.

3.3 ADJUSTING AND CLEANING:

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION:

A. Provide final protection and maintain conditions in a matter acceptable to fabricator and installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 064000

SECTION 071616

CRYSTALLINE WATERPROOFING

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: Crystalline waterproofing for application to interior surfaces of below grade elevator pit walls and floors.

B. Related Sections:
1. Division 3Section - "Cast-in-Place Concrete."
2. Division 7 Section - "Joint Sealants."

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's material descriptions, and technical data indicating tested physical and performance properties of waterproofing material. Include construction details and installation instructions for crystalline waterproofing.

B. Qualification Data: Submit for applicator to demonstrate their capabilities and experience. Include certification by waterproofing manufacturer attesting to applicator's training and lists of completed projects with project names and addresses, architects and owners. Submit for Architect's information only.

C. Product Certificates: Submit manufacturer's certificates for waterproofing, patching, and plugging materials. Submit for Architect's information only.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for crystalline waterproofing. Submit for Architect's information only.

E. Field Quality-Control Reports: Submit inspection report prepared by waterproofing manufacturer's field representative verifying application of materials. Submit for Architect's information only.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall be trained by manufacturer with not less than three-years' experience in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, with a record of successful in-service performance for application work.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.

B. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40-deg. F. or above during work and cure period, and space are well ventilated and kept free of water.

C. Substrate Conditions: Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

D. Work of Other Trades: Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed.

1.6 WARRANTY

A. Watertightness Warranty: Provide written warranty, signed by Installer and countersigned by Contractor agreeing to repair or replace waterproofing that does not comply with requirements or that fails to perform as required, and to maintain watertight conditions within Five (5) years from date of Substantial Completion.
1. Warranty includes responsibility for removing and replacing other work that conceals crystalline waterproofing.
2. During warranty period, repairs and replacements required because of unusual weather phenomena and other events beyond Contractor's or Installer's control shall be completed by Contractor or Installer and paid for by Owner at prevailing rates.

PART 2 - PRODUCTS

2.1 CRYSTALLINE WATERPROOFING MATERIALS

A. Acceptable Products; subject to compliance with requirements provide one of the following:
1. Anti-Hydro International, Inc.; A-H Hydrocap.
2. BASF Corporation; MasterSeal 500.
3. Euclid Chemical Company; Hey'DI K-11.
4. ICS Penetron International Ltd.; Penetron.
5. Vandex USA LLC; Vandex Super.
6. Xypex Chemical Corporation; Xypex.

B. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that

has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.

1. Water Permeability: Maximum zero for water at 30 feet when tested according to CE CRD-C 48.
2. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.

C. Portland Cement: ASTM C 150, Type I.

D. Sand: ASTM C 144.

E. Water: Potable.

2.3 MIXES

A. Crystalline Waterproofing Mix: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Proportion and mix waterproofing compound with water as directed to achieve lump-free, homogeneous, blended slurry consistency.

1. Mix together with mechanical mixer or by hand to required consistency.
2. Do not over mix. After mixing is completed, do not re-temper mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.

B. Proceed with application only after unsatisfactory conditions have been corrected.

C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.

C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.

D. Substrate Repairs: Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
1. Cut out holes, honeycombs, open joints, cracks, voids, tie holes and other defects in concrete substrate effecting application of waterproofing material.
   a. Remove loosened chips and cut or rout out defective areas to depth recommended by waterproofing manufacturer to reveal sound material.
   b. Cut reveal with sides perpendicular to surface, not tapered, and approximately 1-inch deep.
2. Clean and prepare cut and routed out areas and fill with patching compound as recommended by waterproofing manufacturer. Fill reveal with patching compound flush with surface.

E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
1. Clean concrete surfaces according to ASTM D 4258.
   a. Etch scratch- and float-finished concrete with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
   b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

A. Comply with waterproofing manufacturer's written instructions for application and curing.
1. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
2. Apply waterproofing to inside (negativeside) surfaces of elevator pit walls and floors.
3. Number of Coats: Apply in number of coats required for specified water permeability but not less than two (2) coats.
4. Application Method: Either brush or spray application as recommended by waterproofing manufacturer for substrate conditions encountered. Apply to

ensure that each coat fills voids and is in full contact with substrate or previous coat.

5. Dampen surface between coats.

B. Waterproofing Treatment Extensions: Extend waterproofing treatment into sump pits located in elevator pit floors.

C. Final Coat Finish: Apply final coat in manner to achieve brushed or spray textured finish.

D. Curing: Moist-cure waterproofing for not less three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer. Cure by periodic fog spraying and cover with impervious sheeting or other method acceptable to waterproofing manufacturer until coating has set

3.4 PROTECTION

A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, water accumulation and frost.

B. Protect waterproofing from temperatures below 40-deg. F. Provide adequate ventilation where waterproofing is applied in enclosed spaces or pits to ensure suitable air circulation for duration recommended by manufacturer following treatment.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Engage waterproofing manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

1. Waterproofing manufacturer's representative shall inspect substrate and completed application of crystalline waterproofing to verify proper surface preparation and installation of their materials.
2. Notify manufacturer's representative upon completion of surface preparation work and again after completion of waterproofing application to perform required inspections.
3. Waterproofing manufacturer's representative shall provide written report indicating that substrate preparation and waterproofing application complies with manufacturer's written instructions.

END OF SECTION 071616

SECTION 072650

UNDER SLAB VAPOR BARRIER

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: Vapor barrier membrane for installation under concrete slabs on grade.

B. Related Sections:
1. Division 2 Section "Earth Moving" for preparation of building pad and subbase.
2. Division 3 Section "Cast-In-Place Concrete" for concrete slab installation.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical literature and test reports for vapor barrier material indicating compliance with specified requirements. Include installation instructions for placement, seaming of joints and sealing of penetrations.

B. Samples: Submit one foot (12-inches) square sample of vapor barrier material indicating thickness and composition.

1.4 QUALITY ASSURANCE:

A. Inspection: Obtain Architect's inspection and acceptance of installed vapor barrier before placing concrete.

1.5 PROJECT CONDITIONS:

A. Verify that subgrades are compacted, clean and free of debris prior to installation of vapor barrier.

B. Subgrades shall be smooth and without sharp projections which could puncture membrane material.

PART 2 - PRODUCTS

2.1 VAPOR BARRIER:

A. Acceptable Products; subject to compliance with specified requirements:
1. W. R. Meadows, Inc.; Perminator 15 Mil Underslab Vapor-Mat.
2. Reef Industries, Inc.; Griffolyn 15 Mil Green.

3. Stego Industries, LLC; Stego Wrap 15-Mil Class A.

B. Characteristics: Multi-ply, laminated, high density polyolefin or polyethylene membrane meeting ASTM E1745, Class A and having a perm rating less than 0.02 when tested in accord with ASTM E-96, Procedure A.; minimum 15 mils thickness.

C. Accessories:

1. Seam Tape: Type as recommended by vapor barrier manufacturer.
2. Vapor Proofing Mastic: Type as recommended by vapor barrier manufacturer.
3. Pipe Boots or Collars: Construct pipe boots or collars from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify that subgrades are compacted, level, and acceptable for installation of vapor barrier membrane.

B. Correct deficiencies before beginning installation of vapor barrier membrane.

3.2 INSTALLATION:

A. Comply with ASTM E1643 for installation of vapor barriers.

B. Install vapor barrier over compacted granular fill of interior building areas to receive concrete slabs and other locations as indicated.

C. Lay membrane with seams perpendicular to and lapped in direction of pour. Lap and seal edges of membrane, including openings and penetrations.

D. Vapor barrier shall be continuous under slab extending up vertical surfaces within 1/2-inch from top of slab and under joint filler material.

E. Seal penetrations in accord with manufacturer's instructions.

1. Install manufacturer's pipe boots or collars to seal pipes.
2. Seal around pipe banks with mastic as recommended by vapor barrier membrane manufacturer.

F. Repair damages in vapor barrier membrane by cutting patches of same material to overlap damaged areas at least 6-inches and taping all sides for a tight seal.

END OF SECTION 072650

SECTION 074114

STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section Includes: Standing-seam metal roof panel system including roof insulation and related installation accessories.

B. Related Sections:
1. Division 5 Section – "Steel Decking."
2. Division 5 Section – "Cold-Formed Metal Framing."
3. Division 6 Section – "Rough Carpentry."
4. Division 7 Section – " Sheet Metal Flashing and Trim."

1.3 PERFORMANCE REQUIREMENTS:

A. System Performance: Provide manufactured roof panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592.
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 6.24 lbf/sq. ft.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class UL 90 rating.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
1. Temperature Change (Range): 120-degrees F., ambient; 180-degrees F., material surfaces.
2. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

F. FM Approvals Listing: Provide roof insulation materials that comply with requirements in FM Approval Standard 4450 and FM Approval Standard 4470. Roof insulation material shall be listed in FM Approval Guide for classifications specified. Materials shall be identified with FM Approvals markings.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's product specifications for each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings: Show layout of metal roof panels, details of edge conditions, joints, panel profiles, supports, anchorages, trim and flashings.
1. Include roof plan showing layout of insulation boards and attachment methods to meet specified wind-uplift resistance requirements.
   a. Indicate fastener types, sizes, spacings and fastening patterns.
   b. Show roof edge eave and rake details.
2. Include fabrication and installation details for metal roofing.
3. Indicate attachment system, trim, flashings, closures, and accessories; and special details.
4. Indicate fastener types and spacings, expansion provisions and sealant locations.
5. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12-inches (1-ft.).
6. Indicate that the qualified Professional Engineer responsible for preparing structural analysis has reviewed shop drawings.

C. Structural Analysis: Include structural analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation indicating compliance with specified structural performance requirements.

D. Samples:
1. Metal Panels: Submit 12-inch (1-ft.) length by actual panel width indicating profile, style, surface finish and color selected.
2. Metal Roof Accessories: Submit one sample each actual accessory material required. Include fasteners, closures, and other metal panel accessories.
3. Insulation Board: Submit 12-inch (1-ft.) square size sample of roof insulation board indicating foam material and nailable surface.
4. Fasteners: Submit three actual fasteners of type, size and length required for attachment of specified roof insulation board material.

E. Qualification Data: Submit documentation for Installer and Professional Engineer indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

F. Product Test Reports: Submit for each product performed by a qualified testing agency demonstrating compliance with specified performance requirements. (Submit for Architect's information only.)

G. Field Quality-Control Reports: Submit inspection reports and results of field tests performed on installed system prepared by manufacturer's factory-authorized service representative. (Submit for Architect's information only.)

H. Sample Warranties: Submit sample copies of specified warranties. (Submit for Architect's information only.)

I. Maintenance Data: Submit metal panel manufacturer's cleaning and maintenance recommendations. Include with operation and maintenance manuals as part of project closeout documents.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Installer shall have minimum five (5) years' experience in the erection of metal roof panel systems similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated.

C. Mock-Ups: Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mock-ups for typical roof area only, including accessories.
a. Size: Approximately 12-feet length by 6-feet width.
b. Indicate the following:
1) Underlayment application.
2) Panel layout and attachment method to supporting substrate.
3) Exposed seam and seam termination.
4) Flashing trim and accessories.
2. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.
3. Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed.
1. Package metal panels for protection during transportation and handling.
2. Deliver insulation materials to site in manufacturer's original protective packaging with labels intact.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering.
1. Store metal panels to ensure dryness, with positive slope for drainage of water.
2. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
   1. Store in a dry location, away from direct exposure to sunlight. Stack insulation flat when storing.
   2. Weigh down stored materials to prevent from wind damage.

E. Retain strippable protective covering on metal panels during installation.

1.7 PROJECT CONDITIONS:

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION:

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY:

A. Material Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Panel Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: Twenty (20) years from date of Substantial Completion.

C. Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within warranty period of Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS AND FINISHES:

A. Panel Material: Coil-coated aluminum sheet complying with ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Surface: Manufacturer's standard stucco-embossed finish.
2. Thickness: 0.040-inch, minimum.
3. Finish: Coil-coated finish as specified.

B. Flashing and Flat Stock Material: Same material, gauge and finish as specified for panels.

C. Coil-Coated Finishes:
1. Exposed Finish for Exterior Panel Surfaces: Manufacturer's two-coat fluoropolymer finish complying with AAMA 2605 containing not less than 70 percent PVDF resin by weight in color coat.
a. Coating Application: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
b. Color and Gloss: As selected by Architect from manufacturer's standard colors and gloss.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5-mil; applied to pretreated metal surfaces.

2.2 STANDING-SEAM METAL ROOF PANEL SYSTEM:

A. Acceptable Products; subject to compliance with specified requirements:
1. Atas International, Inc.; 2" Field-Lok.
2. Centria; SRS System
3. Fabral / Euramax Company; PowerSeam Standing Seam Roofing System.
4. McElroy Metal, Inc.; 238T Standing Seam Roofing System.
5. Merchant & Evans, Inc.; Zip-Rib.
6. Petersen Aluminum Corporation; Tite-Loc Plus.
7. Innovative Metals Co. Inc.; Series 300.
8. Morin Inc. Corp.; SSR System.

B. Standing-Seam Roof Panels: Manufacturer's standard factory-formed, standing-seam roof panel assembly designed for concealed mechanical attachment of panels to roof deck.
1. Seam Type: Manufacturer's standard bulb seam, double-folded seam or tee-seam with separate cap in matching material and finish; designed for field seaming by use of manufacturer's mechanical machine seamer.
2. Seam Height: 2-inches minimum, 3-inches maximum.
3. Panel Width: 16-inches (1'-4"), nominal.
4. Panel Length: Provide in full continuous lengths without lap seams or joints.
5. Anchor Clips: Manufacturer's standard, floating type panel clips designed to meet wind-uplift resistance rating and accommodate thermal movement; fabricated from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel.

2.3 UNDERLAYMENT MATERIALS:

A. Membrane Underlayment:
1. Acceptable Products; subject to compliance with specified requirements:
a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
2. Characteristics: Self-adhering, high-temperature composite sheet membrane consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
a. Thickness: 30 to 40 mils, minimum.
b. Thermal Stability: Stable after testing at 240-degrees F per ASTM D 1970.
c. Low-Temperature Flexibility: Passes after testing at minus 20-degrees F. per ASTM D 1970.
3. Accessory Products: Provide primer as recommended by underlayment manufacturer for substrate conditions encountered.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 ROOF INSULATION:

A. Acceptable Manufacturers; subject to compliance with specified requirements:
1. Atlas Roofing Corp.
2. Firestone Building Products Co.
3. GAF Materials Corporation.
4. Hunter Panels.
5. Johns Manville Corp.
6. Rmax, Inc.

B. Roof Insulation: Rigid polyisocyanurate insulation boards with non-asphaltic glass facing sheets; meeting ASTM C1289, Type II; FM Approved.
1. Facer Type: Class 1 or 2; felt or glass-fiber mat on both major surfaces.
2. Density and Compressive Strength: As required by roof panel manufacturer's recommendation and engineering analysis.
3. Face Size: Sizes as required to meet specified wind-uplift resistance rating.
4. Thickness: 3.6-inches, minimum.
5. Long Term Thermal Resistance (LTTR) "R" value at 75 degrees F.: R-21.1 (21.1 deg F × h × sq. ft./Btu).
6. Fire Hazard Classification: FM Class I.

C. Insulation Fasteners: Factory-coated, corrosion-resistant, steel fasteners with metal or plastic fastening plates, designed for fastening roof insulation to substrate and acceptable to roofing system manufacturer.
1. Corrosion Resistance: Passing FM 4470 Corrosion Test, modified DIN 50018 standard, with a maximum of 15% red rust after 15 wet and dry acidic atmosphere cycles in Kesternich cabinet.

2. Size: As recommended by manufacturer for board thickness required and specified wind-uplift resistance rating.

2.5 MISCELLANEOUS MATERIALS:

A. Bearing Plates: Fabricated from rolled-formed, galvanized structural steel sheet conforming to ASTM A653, Coating Designation G90; gauges and sizes as required by manufacturer's structural analysis to secure insulation to roof deck and accept anchor clip attachment.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thickness, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters and Downspouts:
1. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required.
a. Fabricate in minimum 96-inch (8-ft.) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual."
b. Furnish gutter supports spaced a maximum of 36-inches (3-ft.) on center, fabricated from same metal as gutters.
c. Provide wire ball strainers of compatible metal at outlets.
d. Finish gutters to match metal roof panels.
2. Downspouts: Formed from same material as roof panels.
a. Fabricate in 10-foot long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual."
b. Finish downspouts to match gutters.

E. Panel Fasteners: Self-tapping stainless steel screws designed to withstand design loads.

F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100-percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic,

nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.

2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187; compounded for 15-mil dry film thickness per coat, unless otherwise indicated.

2.6 FABRICATION:

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer. Provide in sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

E. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

F. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components

are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION:

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

B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

C. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 ROOF INSULATION INSTALLATION:

A. Install roof insulation over roof decking in accordance with final reviewed shop drawings and manufacturer's product data.

B. Attach insulation to roof deck using specified mechanical fasteners and spaced as indicated to achieve wind-uplift resistance rating.

C. Lay insulation boards parallel with eaves with end joints staggered from subsequent boards at least 12-inches (1'-0"). Allow approximately 1/8-inch space between board edges and ends for expansion.

D. Install preservative treated wood nailers and blocking equal to insulation thickness along eaves, rakes and cut-outs and as required. Install nailers and blocking in accord with provisions specified in Division 6 section "Rough Carpentry."

3.3 MEMBRANE UNDERLAYMENT INSTALLATION:

A. Install specified membrane underlayment over entire installed roof insulation surface area in accordance with manufacturer's product data.

B. Prime surfaces as required by underlayment manufacturer’s recommendation for substrate conditions. Apply materials only to clean, dry and sound surfaces as directed by manufacturer’s instructions.

C. Install underlayment beginning at lower edge or eave of deck assembly and working up; removing backing release paper and adhering membrane firm to substrate.
   1. Apply membrane, wrinkle free, in shingle fashion to shed water.
      a. Lap each course over lower course with 4-inches minimum side laps and 6-inches minimum end laps. Roll laps with roller.

b. Stagger end laps at least 24-inches (2-ft.) away from laps in adjacent courses.

2. Install full width underlayment sheet centered along valleys and ridges; extending equal distance each side with membrane pressed firm in place.
   a. Apply membrane to valleys before application of underlayment at eaves and subsequent courses.
   b. Where roofing meets walls and similar vertical surfaces, extend underlayment up vertical surfaces, minimum 6-inches.

D. Do not allow installed underlayment to be exposed to the weather for prolong periods; cover with specified metal roof panels as soon as possible, within fourteen (14) days following membrane application.

3.4 METAL PANEL INSTALLATION:

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work secured in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
1. Install panel anchor clips using bearing plates positioned over membrane underlayment and roof insulation.
2. Attach panel clips using fasteners of size and length required by manufacturer's design to extend through bearing plate, membrane underlayment and roof insulation, penetrating through roof deck to provide ample anchorage to meet specified wind uplift requirements.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10-feet with no joints allowed within 24-inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eaves with gutter hangers spaced not more than 36-inches on center using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1-inch away from walls; locate fasteners at top and bottom and at approximately 60-inches on center in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Connect downspouts to underground drainage system indicated.

J. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES:

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4-inch in 20-feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports for submittal to Architect.

3.7 CLEANING AND PROTECTION:

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions.
   1. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer.
   2. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074114

SECTION 074293

SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal soffit cladding.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal cladding; details of edge conditions, joints, cladding profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Cladding: 12 inches (305 mm) long by actual cladding width. Include fasteners, closures, and other metal cladding accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal cladding to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal cladding, and other manufactured items so as not to be damaged or deformed. Package metal cladding for protection during transportation and handling.

B. Unload, store, and erect metal cladding in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal cladding horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal cladding to ensure dryness, with positive slope for drainage of water. Do not store metal cladding in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal cladding during installation.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal cladding to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

A. Coordinate metal cladding installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal cladding systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Cladding Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal cladding that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Cladding Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal cladding systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT CLADDING

A. Provide metal soffit claddings designed to be installed by lapping and interconnecting side edges of adjacent cladding and mechanically attaching through cladding to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Cladding:

1. Finish: Match selected roofing color.

C. Flush-Profile Metal Soffit Cladding: Extruded shapes with flush joints.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Knotwood; a brand of OmniMax International; Soffits or comparable product by one of the following:

    a. Dizal.
    b. Longboard, a Division of Mayne Inc.

2. Extruded Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

    a. Extruded Aluminum Bars and Shapes: ASTM B209 (ASTM B209M), Alloy 6060-T5.
    b. Panel Width: Nominal 6 inches.
    c. Thickness: 0.055-inch (1.4-mm).
    d. Surface: Smooth, flat finish.
    e. Exterior Finish: Powder coating with art sublimation.
    f. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal cladding system.

B. Cladding Accessories: Provide components required for a complete, weathertight cladding system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal cladding unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal cladding profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal cladding as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal cladding.

D. Cladding Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal cladding by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Cladding Sealants: Provide sealant types recommended by manufacturer that are compatible with cladding materials, are nonstaining, and do not damage cladding finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal cladding and remain weathertight; and as recommended in writing by metal cladding manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish metal cladding and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide cladding profile, including major ribs and intermediate stiffening ribs, if any, for full length of cladding.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal cladding manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit cladding manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Extruded Aluminum Cladding and Accessories:

A. Powder-Coat Finish: AAMA 2605 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Examine framing to verify that girts, angles, channels, studs, and other structural cladding support members and anchorage have been installed within alignment tolerances required by metal cladding manufacturer.
2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal cladding manufacturer.

B. Examine roughing-in for components and systems penetrating metal cladding to verify actual locations of penetrations relative to seam locations of metal cladding before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous cladding support members and anchorages in accordance with ASTM C754 and metal cladding manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports**,** as required to comply with requirements for assemblies indicated.

3.3 INSTALLATION

A. Install metal cladding in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install cladding perpendicular to supports unless otherwise indicated. Anchor metal cladding and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal cladding.
2. Flash and seal metal cladding at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal cladding are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal cladding work proceeds.
6. Locate cladding splices over, but not attached to, structural supports. Stagger cladding splices and end laps to avoid a four-cladding lap splice condition.
7. Provide weathertight escutcheons for pipe- and conduit-penetrating cladding.

B. Fasteners:

1. Aluminum Cladding: Use aluminum or epoxy-coated steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal cladding manufacturer.

D. Lap-Seam Metal Cladding: Fasten metal cladding to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply cladding and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal cladding.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or cladding. Install screws in predrilled holes.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal cladding system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal cladding manufacturer; or, if not indicated, provide types recommended by metal cladding manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners

where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal cladding is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal cladding installation, clean finished surfaces as recommended by metal cladding manufacturer. Maintain in a clean condition during construction.

B. After metal cladding installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal cladding that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section Includes:
1. Formed sheet metal flashing and trim work, including but not limited to the following:
a. Counter flashing system.
2. Miscellaneous sheet metal accessories as indicated and as required by project conditions.

B. Exposed formed sheet metal fabrications are to be prefinished as specified, in manufacturer's standard non-metallic colors selected by Architect.

C. Related work specified elsewhere includes:
1. Division 7 Section - "Joint Sealants."

1.3 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Performance Requirements: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Design Requirements: Design, fabricate and install copings and roof edge flashings to comply with ANSI/SPRI ES-1 and requirements of governing building code , based on wind loading conditions for the Project.

C. Sheet Metal Standard for Flashing and Trim: Comply with NRCA "The NRCA Roofing Manual" and SMACNA "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

D. Thermal Movements: Allow for thermal movements from indicated ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
1. Temperature Change: 120-deg F, ambient; 180-deg F, material surfaces.
2. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1.4 SUBMITTALS:

A. Product Data: Submit for sheet metal materials and accessories. Include manufacturer's current technical product data, installation instructions and general recommendations for each specified sheet metal material, fabricated product, coating system, and color selection data.

B. Shop Drawings: Show layout, profiles, methods of joining, and anchorages details.
   1. Provide layouts at 1/4-inch scale and details at 3-inch scale.
   2. Show fabrication details and installation layouts, expansion-joint locations, and keyed details.
   3. Indicate material, metal thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing sheet metal fabrications. Show layout and spacing of fasteners, cleats, clips, and other attachments.
   6. Include details of connections to adjoining work.

C. Samples: Submit the following sheet metal flashing and accessory items:
   1. Physical sheet metal color samples where selection is required.

D. Qualification Data: Submit fabricator and installer to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

1.5 QUALITY ASSURANCE:

A. Fabricator Qualifications: Fabricator's shop shall employ skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose fabrication work have a record of successful in-service performance with minimum Five (5) years' experience. Shop shall be listed as able to fabricate copings and roof edge flashings that are SPRI ES-1 tested and approved.

B. Installer Qualifications: Installer shall have not less than Five (5) years' experience in the completion of sheet metal flashing and trim installation work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

C. Regulatory Requirements: Comply with roof edge securement requirements of the International Building Code (IBC), 2012 edition, with State of Georgia amendments.

D. Mock-Up: Build mockups to demonstrate workmanship, aesthetic effects, and to set quality standards for fabrication and installation.
   1. Construct mockup of typical coping and roof edge fascia flashing of approximate 10-feet length located on portion of building as directed by Architect. Mock-up shall include the following:
      a. Supporting construction, cleats, seams, attachments, and accessories.
      b. Typical mitered corner installation indicating seam construction and sealing method.
      c. Joint splice method with expansion provisions.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 PROJECT CONDITIONS:

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.8 WARRANTY:

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

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS AND FINISHES:

A. Aluminum Sheet Material: Coil-coated aluminum sheet complying with ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and performance required.
   1. Thickness: 0.040 inch, minimum, unless otherwise indicated.
   2. Surface: Smooth, flat.
   3. Finish: Coil-coated finish as specified.

B. Coil-Coated Finishes for Aluminum Sheet Material:

1. Exposed Finish: Two-coat fluoropolymer finish system complying with AAMA 2605, with a total dry film thickness of not less than 1.0-mils. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Coating Material: Fluoropolymer coating containing not less than 70-percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
   b. Color: As selected by Architect from manufacturer's standard non-metallic colors.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish applied to pretreated metal surface. Coating system shall consist of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES:

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Provide wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item, unless otherwise indicated.

1. Blind fasteners or self-drilling screws shall be gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
2. Fasteners for Aluminum Sheet Metal: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion meeting ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

I. Membrane Subflashing: Minimum 40 mil thickness, non-reinforced, homogeneous vinyl sheet.

J. Felt: Asphalt-saturated organic felt meeting ASTM D226, Type II (No. 30), non-perforated.

K. Paper Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft., minimum.

L. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

M. Adhesives: Type recommended by flashing or underlayment manufacturers as applicable for waterproof and weather-resistant seaming and adhesive application of flashing and underlayment materials.

N. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

O. Concrete Splashblocks: Precast concrete units, minimum 4000-psi compressive strength; minimum 2-inches thickness by 12-inches (1'-0") width by 18-inches (1'-6") length, smooth formed.

2.3 FABRICATION:

A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in referenced sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate flashing for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
4. Obtain field measurements for accurate fit before shop fabrication.
5. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
6. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
7. Provide matching materials and finish for fascia metal covering, flashing, counterflashing and trim.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4-inch in 20-feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of interlocking hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to referenced sheet metal standard.

E. Seams for Aluminum Sheet Metal:
   1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
   2. Pop-rivet joints for additional strength where required and at vertical faces.

F. Do not use graphite pencils to mark metal surfaces.

G. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer or fabricator.

H. Counter Flashing Systems: Fabricate in two-piece configuration with receiver, similar to SMACNA Figure. 4-4C, to allow removal of counter flashing for future re-roofing applications. Form receiver with legs to extend behind wall finish materials and for integration with air barrier flashing membrane.

I. Roof Penetration Hoods: Fabricate from specified aluminum sheet material according to SMACNA Figure 4-14A and as detailed on drawings. Notch side of hood to fit accurate around pipe penetration with not greater than 1/4-inch clearance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrates are sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 INSTALLATION REQUIREMENTS:

A. Install sheet metal flashing and trim to comply with specified performance requirements, manufacturer's installation instructions, and referenced sheet metal standards.

1. Install fasteners**,** protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds and sealant.
3. Anchor sheet metal flashing and trim and other components of the Work secured in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12-inches (1-ft.) on center.
6. Space individual cleats not more than 12-inches (1-ft.) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or referenced sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10-feet with no joints within 24-inches of corner or intersection.

1. Form expansion joints of interlocking hooked flanges, not less than 1-inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1-inch into sealant. Form joints to completely conceal sealant.

a. When ambient temperature at time of installation is between 40-deg F. and 70-deg F., set joint members for 50-percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

b. Do not install sealant-type joints at temperatures below 40-deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section - "Joint Sealants."

G. Field Seams: Install non-moving seams with flat-lock seams sealed with elastomeric sealant unless otherwise unless otherwise recommended by sealant manufacturer for intended use.

3.3 FORMED SHEET METAL INSTALLATION

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and referenced sheet metal standards.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.

2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Counterflashing: Coordinate installation of counterflashing with installation of roof base flashing. Insert counterflashing in receivers and fit tightly to base flashing. Extend counterflashing 4-inches over base flashing.

1. Lap counterflashing joints minimum of 4-inches.

2. Secure in waterproof manner by means of snap-in installation and seal with sealant.

C. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing according to roofing manufacturer's recommendations.

D. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Attach and seal flashing to equipment support member.

E. Roof Penetration Hoods: Install with flanges extending under roofing membrane and attached to wood nailers as directed by roofing system manufacturer’s product data. Attach top hood section to base portion with compatible corrosion-resistant screws and fitted neat around piping. Seal around pipe penetrating hood with compatible sealant.

3.4 ERECTION TOLERANCES:

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

3.5 CLEANING AND PROTECTION:

A. Upon completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

B. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

1. After cleaning, repair and restore damaged metal and metal finishes with prefinished paint manufacturer's special air-drying touch-up paint, in manner such that touch-up is not apparent.
2. Replace damaged flashing and sheet metal work which cannot be repaired and when finish repair and restoration is not acceptable to Architect.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

D. Protection: Protect installed flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF FLASHING AND SHEET METAL

SECTION 079200

JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Silicone weatherseal sealant.
2. One-part polyurethane sealant.
3. Silicone bath sealants.
4. Polyurethane sealant for horizontal traffic-bearing joints.
5. Acrylic-latex caulking compound.

B. Related Sections:
1. Division 4 Section – "Unit Masonry."
2. Division 8 Section – "Aluminum-Framed Entrances and Storefronts."
3. Division 9 Section – "Gypsum Board Assemblies."
4. Division 9 Section – "Acoustical Panel Ceilings."
5. Division 9 Section – "Painting."

1.2 DEFINITIONS

A. Sealant: A weatherproof elastomer used in filling and sealing joints, having properties of adhesion, cohesion, extensibility under tension, compressibility and recovery; designed to make joints air and watertight. Material is designed generally for application in exterior joints and for joints subject to movement.

B. Caulking Compound: A material used in filling joints and seams, having properties of adhesion and cohesion; not required to have extensibility and recovery properties, generally for application in interior joints.

C. Caulk: The process of filling joints, without regard to type of material.

D. Joint Failure: A caulked joint exhibiting one or more of the characteristics listed below.
1. Air and/or water leakage.
2. Migration.
3. Loss of adhesion.
4. Loss of cohesion.
5. Failure to cure.
6. Discoloration.
7. Staining of adjacent work.
8. Development of bubbles, air pockets or voids.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, indicating conformance with specified requirements. Include installation instructions for each type sealant. Indicate preparation requirements for each substrate condition.

B. Color Samples: Submit samples for each type sealant specified. Samples shall be actual materials. Architect reserves the right to reject work not in conformance with selected colors, based upon samples submitted.

C. Adhesion Compatibility Tests: Submit letter from sealant manufacturer indicating that adhesion and compatibility testing have been performed on actual samples of aluminum storefront and curtain wall framing components.

1. Test results shall determine if materials are compatible and that adhesion is acceptable.
2. Indicate requirements for primers or special preparation for adhesion.
3. Testing will not be required if sealant manufacturer has conducted previous testing on current sealant products for adhesion and compatibility with specified framing components, joint substrates and other materials identical to those required for this Project and submits joint preparation data that are based on these tests indicating acceptable adhesion. Test results shall be current within the past two (2) years.

1.4 QUALITY ASSURANCE

A. Single Source Requirements: Each type joint sealant used throughout the Project shall be the product of a single manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in manufacturer's original packaging.

B. Store materials in accordance with manufacturer's instructions complying with environmental conditions and recommended temperature ranges.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:

1. Install no materials under adverse weather conditions, or when temperatures are below or above those recommended by manufacturer's product data, or when substrate moisture content is above recommended levels.
2. Proceed with work only when forecasted weather conditions are favorable for joint cure and development of high early bond strength.
3. Wherever joint width is affected by ambient temperature variations, install materials only when temperatures are in lower third of manufacturer's recommended installation temperature range.
4. Do not install sealant materials when substrate temperature is below 40 degrees F.

B. Protection of Adjacent Surfaces:

1. Protect by applying masking material or manipulating application equipment to keep materials in joint. if masking materials are used, allow no tape to touch cleaned surfaces to receive sealant. Remove tape immediately after caulking, before surface skin begins to form.
2. Remove misapplied materials from surfaces using solvents and methods recommended by manufacturer.
3. Restore surfaces from which materials have been removed to original condition and appearance.

1.7 WARRANTY

A. Warrant work to be free from defects in materials and workmanship, including joint failure, for a period of Two (2) years, beginning at Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SILICONE WEATHERSEAL SEALANT:

A. Acceptable Products; subject to compliance with specified requirements:
1. Dow Corning Corp.; 790 Silicone Building Sealant.
2. Pecora Corp.; 890NST.
3. Tremco, Inc.; Spectrum I.

B. Characteristics:
1. Type: One part low modulus silicone rubber; meeting ASTM C 920, Type S, Grade NS, Class 100/50.
2. Joint Movement Capability: Plus 100% extension, minus 50% compression, minimum.
3. Colors: As selected by Architect from manufacturer's standard full range color selection.

2.2 ONE-PART POLYURETHANE SEALANT:

A. Acceptable Products; subject to compliance with specified requirements:
1. BASF Corporation; MasterSeal NP 1.
2. Pecora Corp., Dynatrol™ I-XL
3. Sika Corporation; Sikaflex-1a
4. Tremco, Inc., Dymonic 100.

B. Characteristics:
1. Type: One-part, non-sag, elastomeric polyurethane sealant meeting ASTM C920, Type S, Grade NS, Class 25; compatible for painting.
2. Color: As selected by the Architect from Manufacturer’s standard selection for compatibility with paint colors used.

2.3 POLYURETHANE SEALANT FOR HORIZONTAL TRAFFIC-BEARING JOINTS:

A. Acceptable Products; subject to compliance with specified requirements:
   1. BASF Corporation; MasterSeal SL 1 or SL 2
   2. Pecora Corporation; Urexpan NR-200 or DynaTrol II-SG.
   3. Sika Corporation; Sikaflex-2c SL.
   4. Sonneborn / BASF Construction Chemicals, LLC; Sonolastic SL-1 or SL-2.
   5. Tremco, Inc.; Vulkem 45SSL or THC-901.

B. Characteristics:
   1. Type: Single or multi-component, polyurethane sealant formulated for horizontal traffic bearing surfaces, meeting ASTM C920, Type S or M, Grade P or NS, Class 25; self-leveling for flat surfaces and non-sag for sloped surfaces.
   2. Color: As selected by the Architect from Manufacturer's standard selection.

2.4 SILICONE BATH SEALANT:

A. Acceptable Products; subject to compliance with specified requirements:
   1. BASF Corporation; MasterSeal 121.
   2. Dow Corning Corp.; 786 Mildew-Resistant Silicone Sealant.
   3. Momentive Performance Materials, Inc. (GE); SCS 1700 Sanitary Silicone Sealant.
   4. Pecora Corporation; 898NST Sanitary Mildew Resistant Silicone Sealant.

B. Characteristics:
   1. Type: One part silicone rubber; mildew and stain resistant meeting ASTM C 920, Type S, Grade NS; USDA or FDA approved.
   2. Color: White.

2.5 ACRYLIC-LATEX CAULKING COMPOUND:

A. Acceptable Products; subject to compliance with specified requirements:
   1. C.R. Laurence Company, Inc.; CRL 321.
   2. Momentive Performance Materials, Inc.; GE Max 2500 Caulk.
   3. Pecora Corp.; AC-20 +Silicone.
   4. Tremco, Inc.; Tremflex 834.

B. Characteristics: One-part, flexible, non-sag, non-staining, non-bleeding, paintable, siliconized acrylic-latex emulsion compound meeting ASTM C 834.

2.6 ACCESSORY MATERIALS:

A. Joint Cleaner: Type recommended by material manufacturer for substrates indicated.

B. Joint Primer/Sealer: Type recommended by material manufacturer for conditions, exposures and substrates indicated.

C. Bond Breaker Tape: Plastic tape applied to contact surfaces where bond to substrate or joint filler must be avoided for material performance.

D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam or neoprene foam as recommended by material manufacturer for compatibility with sealant. Provide size and shape or rod to control joint depth, break bond at bottom of joint, form optimum shape of bead on back side and minimize possibility of extrusion when joint is compressed.

E. Tooling Agent: Agent recommended by the material manufacturer to insure contact of material with inner joint faces.

F. Divider Strips: Synthetic rubber or closed cell synthetic foam not less than 1/16-inch thickness and full depth of sealant or caulking compound; approved by manufacturers of dissimilar materials as being compatible with each other.

PART 3 EXECUTION

3.1 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before caulking joints. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond.

B. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless material manufacturer's product data indicates alkalinity does not interfere with bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution; rinse with clean water and allow to dry before caulking.

3.2 APPLICATION

A. Comply with sealant and caulking materials manufacturer's product data, except where more stringent requirements are specified.

B. Prime or seal joint surfaces where recommended by material manufacturer. Do not allow primer/sealer to spill or migrate onto adjacent surfaces.

C. Install backer rod for all sealant and caulking materials, except where recommended to be omitted by the material manufacturer for application indicated. Place backer rod to maintain recommended sealant thickness and profiles. Substitute bond breaker tape for shallow, closed joints.

D. Employ installation techniques which will ensure that materials are deposited in uniform, continuous ribbons without gaps or air pockets, with complete wetting of joint bond surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form slight cove, so that joint will not trap moisture and debris.

E. Do not allow materials to overflow or spill onto adjacent surfaces. Use masking tape or other methods to prevent staining of adjacent surfaces.

F. Remove excess and misplaced materials as work progresses. Clean adjoining surfaces to eliminate evidence of misplaced materials, without damage to adjacent surfaces or finishes.

G. Tool joints of non-sag sealants to concave profile with smooth uniform surface, flush with edges of substrate. Maintain sealant depth-to-width ratio in accordance with manufacturer's product data.

H. Cure sealants and caulking compounds in accordance with manufacturer's product data to obtain high early bond strength, internal cohesive strength and surface durability. Protect uncured surfaces from contamination and physical damage.

3.3 SEALANTS AND CAULKING SCHEDULE

A. Exterior Joints:

1. Exterior brick masonry expansion and control joints, including joints abutting other adjacent materials: Silicone Weatherseal Sealant.
2. Exterior cast stone masonry joints, including expansion and control joints: Silicone Weatherseal Sealant.
3. Exterior joints around perimeter of aluminum curtain wall framing: Silicone Weatherseal Sealant.
4. Exterior joints around perimeter of aluminum storefront framing: Silicone Weatherseal Sealant.
5. Exterior joints at perimeter of hollow metal framing: Silicone Weatherseal Sealant.
6. Exterior joints at perimeter of metal soffit panels: Silicone Weatherseal Sealant.
7. Exterior joints in fiber-cement panels: One-Part Polyurethane Sealant.
8. Exterior joints around molded polyurethane millwork: One-Part Polyurethane Sealant.
9. Bedding joints for thresholds: Silicone Weatherseal Sealant.
10. Exterior horizontal traffic-bearing joints, including concrete walks and slabs: Polyurethane Sealant for Horizontal Traffic-Bearing Joints.

B. Interior Joints:

1. Interior masonry control joints: One-Part Polyurethane Sealant.
2. Interior horizontal (traffic-bearing) joints in concrete floor slabs; including control joints: Polyurethane Sealant for Horizontal Traffic-Bearing Joints.
3. Typical interior joints and seams at abutting and adjacent materials: Acrylic-Latex Caulking Compound.
4. Interior joints in conjunction with vanities, plumbing fixtures and toilet room finishes: Silicone Bath Sealant.

END OF SECTION 079200

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section Includes: Hollow metal doors and frames, including borrowed lite frames.

B. Related work specified elsewhere includes:
1. Division 6 Section – "Rough Carpentry"
2. Division 8 Section – "Flush Wood Doors."
3. Division 8 Section – "Door Hardware"
4. Division 8 Section – "Glazing."
5. Division 9 Section – "Gypsum Board Assemblies"
6. Division 9 Section – "Painting"

1.3 PERFORMANCE REQUIREMENTS:

A. Quality Standards: Provide doors and frames complying with Steel Door Institute ANSI/SDI-A250.8 "Recommended Specifications for Standard Steel Doors and Frames (SDI-100)" and as herein specified.

B. Physical Endurance: Comply with performance requirements for specified level and model classification in accordance with ANSI/SDI-A250.8-2014 (SDI-100) and ANSI/SDI-A250.4-2011 for frames, frame anchors and hardware reinforcing.

C. Finish Performance: Comply with the standard performance criteria of ANSI A250.10-2011 for primed steel surfaces.

D. Thermal Performance: U=0.07 (R=14) or better for exterior doors, complying with SDI 113-13.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of steel doors and frames.
1. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.
2. Include details of conduit and preparations for power, signal, and control systems.

3. Show anchorage and accessory items.
4. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

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

1.5 QUALITY ASSURANCE:

A. Source Limitations: Obtain hollow metal work from a single source and from a single manufacturer.

B. Pre-Installation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equivalent in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

D. Store frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch spacers between each stacked door to permit air circulation. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with specified requirements:
1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Habersham Metal Products Company
4. Mesker Door Inc.
5. Pioneer Industries, Inc..
6. Republic Doors and Frames.
7. Steelcraft / Allegion, plc .

2.2 MATERIALS:

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Galvanized or Galvannealed Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 zinc-coated (galvanized) or A60 zinc-iron alloy-coated (galvannealed) with smooth and paintable finish.

D. Frame Anchors:

1. Anchors for Interior Frames: ASTM A 879/A 879M, Commercial Steel (CS), Coating Designation 04Z; mill phosphatized.

2. Anchors for Exterior Frames: Steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Galvanizing Repair Paint: High zinc dust content paint for repair of galvanized surfaces damaged by fabrication or welding, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

H. Shop Applied Primer: Rust-inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.

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

2.3 HOLLOW METAL DOORS:

A. Door Designs: As indicated on Drawings.

B. Door Thickness: 1-3/4 inch unless otherwise indicated.

C. SDI Door Classification: Level III (Extra Heavy Duty), Model 2 (Seamless) per ANSI/SDI A250.8 for all interior and exterior doors, including fire-rated doors.

D. Door Construction:

1. Door Faces: Complying with requirements of specified door classification.

a. Interior Doors: Fabricated from specified cold-rolled steel sheets; minimum 16-gauge (0.053-inch) thickness.

b. Exterior Doors: Fabricated from specified hot dip galvanized or galvannealed steel sheets; minimum 16-gauge (0.053-inch) thickness.

2. Internal Core:

a. Interior Doors: Manufacturer's standard kraft-paper honeycomb or vertical steel-stiffener core.

b. Exterior Doors: Manufacturer's polyurethane core meeting specified thermal performance requirements.

c. Fire Doors: Core material and construction as required to provide fire protection and temperature-rise ratings indicated and complying with specified fire testing requirements.

3. Vertical Edges for Single-Acting Doors: Beveled edge to 1/8-inch in 2 inches.

4. Top and Bottom Edge Closures: Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 16-gauge (0.053-inch) thickness steel channels, with channel webs placed even with top and bottom edges; flush welded.

5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

6. Weeps: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2.4 HOLLOW METAL FRAMES:

F. Frame Profiles: All frames shall be of double rabbeted profile; except where single-rabbeted frames are specifically indicated on the Drawings.

G. SDI Frame Classification: Level III (Extra Heavy Duty) per ANSI/SDI A250.8.

H. Frame Construction: Welded frames fabricated from steel sheet materials as specified. Knock-down frames shall not be permitted.

1. Interior Frames: Fabricated from specified cold-rolled steel sheets; minimum 16-gauge (0.053-inch) thickness.

2. Exterior Frames: Fabricated from specified hot dip galvanized or galvannealed steel sheets; minimum 16-gauge (0.053-inch) thickness.

3. Frames for Borrowed Lights: Fabricated same as adjacent door frame but not less than 16-gauge (0.053-inch) thickness steel sheet material.

4. Frame Corners: Mitered or coped and full profile welded. Welds shall be dressed and ground smooth with no visible seams.

I. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames. Reinforcement shall be provided for strikes, closers and brackets, and other surface applied hardware for field drilling and tapping.

J. Temporary Spreaders: Provide frames with removable temporary spreader bars welded to bottom of each jamb and maintain in place during shipping, storage and handling.

K. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.

L. Frame Anchors: Fabricated from not less than 18-gauge (0.042-inch) specified steel sheet for interior frames.
1. Floor anchors: Clip type with 5/16-inch holes holes provided to receive two fasteners per jamb; welded to inside of each jamb at frame bottom for securing to floor substrate.
2. Jamb Anchors: Provide anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
    a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 18-gauge (0.042-inch) thickness.
    b. Post-Installed Expansion Type for Frame Installation to In-Place Masonry: Post-installed expansion anchor assembly consisting of minimum 3/8-inch diameter countersunk, flat head, stove bolts with expansion shields, spaced 6-inch maximum from top and bottom of frame and 24-inches (2-ft) on center , maximum in between. Provide with 16-gauge steel shield and sleeve spacers at each bolt, fitted inside frames.
    c. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames having no floor anchors. Provide one additional anchor for each 24-inches of frame height above 7-feet.

M. Setting Bars: Furnish welded frames with setting bars for installation use.

2.5 LOUVERS, STOPS MOLDINGS AND ACCESSORIES:

A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8-inch high unless otherwise indicated.

B. Louvers: Sightproof design, inverted 'V' or 'Y' type, with minimum 20-gauge (0.032-inch) blades welded in 18-gauge (0.042-inch) thickness frame; providing minimum 50-percent free air movement.

C. Exposed Fasteners: Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FABRICATION:

A. Fabricate hollow metal door and frame 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, to assure proper assembly at project site.

B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel.

C. Fabricate exterior doors, panels and frames from specified galvanized sheet steel.

D. Fabricate frames in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Frames shall be formed by press brake with corners sharp and true.
2. Corners shall be mitered and accurately fitted, and shall be fully electrically welded and then ground smooth.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Finish Hardware Preparation:
1. Prepare doors and frames to receive mortise and concealed finish hardware according to final reviewed Finish Hardware Schedule and templates provided by hardware supplier.
2. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
3. Reinforce doors and frames frames to receive surface applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
4. Doors and frames shall be accurately mortised for hardware.
5. Locate finish hardware as indicated on final shop drawings, or if not indicated, in accordance with "Recommended Locations for Builders' Hardware," published by Door and Hardware Institute.
6. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches on center. and not more than 2 inches on center from each corner.

H. Use galvanizing repair paint to coat surfaces damaged by fabrication or welding.

I. Shop Painting:
1. Clean, treat and paint exposed surfaces of metal door and frame units, including galvanized surfaces.
2. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
3. Use galvanizing repair paint for galvanized surfaces damaged by fabrication or welding, prior to prime coat.
4. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

J. Fabrication Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

PART 3 - EXECUTION

3.1 INSTALLATION**:**

A. Install hollow metal doors frames and accessories according to final reviewed shop drawings and manufacturer's written instructions, and as herein specified.

B. Placing Frames:
1. Comply with provisions of ANSI/SDI A250.11 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.
2. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. Remove temporary braces and spreaders leaving surfaces smooth and undamaged.
3. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
4. Pack mineral-fiber insulation solid behind frames in metal-stud partitions.
5. In masonry construction, locate a minimum of 3 wall anchors per jamb at hinge and strike levels. Add one (1) wall anchor per jamb at hinge and strike levels for each whole 1'-10" height increment over 6'-0"; similar at glazed and cased openings.
6. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
7. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
8. Install fire-rated frames according to NFPA 80.

C. Door Installation:
1. Fit doors accurately in hollow metal frames, within clearances specified in SDI-100.
2. Install fire-rated doors with clearances as specified in NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
4. Install silencers after all painting of frames has been completed.

3.2 INSTALLATION TOLERANCES:

A. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

3.3 ADJUST AND CLEAN:

B. Prime Coat Touch-up:
   1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
   2. Use galvanizing repair paint for galvanized surfaces, prior to prime coat.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving hollow metal frames undamaged and in sound condition for hanging doors.

END OF SECTION 081113

SECTION 081416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section Includes: Solid core flush wood doors with veneer faces.

B. Related Sections:

1. Division 8 Section - "Hollow Metal Doors and Frames."
2. Division 8 Section - "Door Hardware."
3. Division 8 Section – "Glazing."

1.3 SUBMITTALS:

A. Product Data: Submit door manufacturer's technical data for each type of door and frame, including details of core and edge construction, and trim for openings and louvers.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Show locations of cutouts.
3. Dimension and detail glass lite openings.
4. Indicate requirements for factory finishing and machining.
5. Indicate fire ratings for fire doors.
6. Use same reference numbers indicated on contract drawings in preparing schedules.

C. Samples:

1. For Initial Selection: Submit manufacturer's full range sample charts of factory-finished doors for selection.
2. For Verification: Submit sample of selected factory finish applied to actual door face materials, approximately 8 by 10 inches for each material and finish.

1.4 QUALITY ASSURANCE:

A. Quality Standards: Comply with the following standards:

1. WDMA Quality Standard: I.S. 1-A Series, "Industry Standard for Wood Flush Doors" of Window and Door Manufacturers Association (WDMA).

2. AWI Quality Standard: "Architectural Woodwork Standards", 1st Edition, including Section 9 "Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. WDMA Quality Marking:

1. Mark each wood door with WDMA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of WDMA I.S. 1-A Series.

2. For manufacturers not participating in WDMA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

C. Single Source Limitations: Obtain doors from a single manufacturer, selecting from specified manufacturers listed herein.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.

2. Smoke and Draft Control: Fire rated door assemblies shall be listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

1.5 DELIVER, STORAGE AND HANDLING:

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors" as well as with manufacturer's instructions.

B. Package factory finished doors individually in opaque plastic bags or cardboard cartons.

C. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY:

A. General: Warranties shall run concurrently with, be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents or otherwise.

B. Door Manufacturer's Warranty:

1. Submit written agreement on door manufacturer's standard form signed by

Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist), or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

2. Warranty shall also include refinishing and reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
3. Warranty shall commence on date of Substantial Completion.
4. Warranty Period for Solid-Core Interior Doors: Life of installation

C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with requirements, provide doors by one of the following:
1. Eggers Industries, Architectural Door Division.
2. Graham / ASSA ABLOY Group.
3. Marshfield-Algoma / Masonite Architectural.
4. Oshkosh Architectural Door Co.
5. VT Industries, Inc.

2.2 INTERIOR FLUSH WOOD DOORS:

A. Veneer-Faced Door Construction: Five plies with stiles and rails bonded to core material, then entire unit abrasive planed before veneering.
1. Bonding Method: Faces veneers bonded to core using a hot press.
2. Door Thickness: 1-3/4 inch, unless otherwise indicated.
3. AWI Grade: Premium.
4. Faces for Transparent Finish: Red Oak, Plain Sliced.
a. Veneer Grade: Grade A faces.
b. Veneer Matching: Book matched, center matched.
c. Appearance: Veneer face shall be consistent with similar color and appearance at both sides of doors, with no green or brown colored wood.

B. Solid Particleboard Core Doors: PC-5 (Particle board core, 5-ply, hot-pressed method).
1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as follows**:**
a. 5-inch top-rail blocking, in doors indicated to have closers.
b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.

c. 5-inch midrail blocking, in doors indicated to have exit devices or provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Fire-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
3. Fire Pressure Edge Sealing System: Manufacturer's concealed integral intumescent seals located behind stiles and endrail designed to meet requirements for Category A positive pressure fire test method.

D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
   a. 5-inch top-rail blocking.
   b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
   c. 5-inch midrail blocking, in doors indicated to have armor plates.
   d. 5-inch midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 LIGHT FRAMES AND MOLDINGS:

A. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. Fire-Rated Applications: At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.4 FABRICATION:

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

1. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
3. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Light Openings:

1. Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind of door required.
2. Trim light openings with moldings of material and profile indicated.
3. Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section – "Glazing."

2.5 FACTORY FINISHING

A. Factory finish doors that are indicated to receive transparent finish.

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

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

D. Transparent Finish:

1. Grade: Premium.
2. Finish: Manufacturer's standard finish with performance comparable to AWI System 5 - Conversion Varnish or AWI System 11 - Catalyzed Polyurethane.
   a. Stain: As selected by Architect from manufacturer's full range.
   b. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine doors, frames and rough openings, with Installer present, before starting installation of frames and hanging doors.

1. Verify that doors and frames comply with indicated requirements for type, size, location, and swing characteristics.
2. Reject doors and frames with defects.

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

3.2 INSTALLATION:

A. Install doors complying with manufacturer's written instructions, referenced quality standard, and final reviewed shop drawings.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

B. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

D. Hardware Installation: Comply with Division 8 Section "Door Hardware."

1. Install doors using approved hardware as scheduled.
2. Use threaded-to-the-head wood screws furnished by hardware manufacturer to mount hardware to doors and frames. Drill pilot holes for all screws prior to installation.
3. Attach hardware secure in correct position and alignment for proper function.

3.3 ADJUSTING, CLEANING AND PROTECTION:

A. Upon door installation, verify for proper operation, fit and swing. Make adjustments as required to ensure for smooth, quiet operation. Re-hang or replace doors which bind or sag.

B. Replace doors that are damaged or do not comply with specified requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

C. Provide protective measures to ensure that installed doors will be without damage, soils or stains throughout remainder of construction.

D. Clean finished door and frame surfaces free of dust, smudges, soils and similar contaminations during final cleaning in accordance with finish manufacturer's recommendations.

END OF SECTION 081416

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. This Section includes access doors for installation in the following types of construction:
1. Gypsum drywall.
2. Unit masonry.
3. Other construction as otherwise indicated.

B. Provide fire-rated access doors where indicated or scheduled, and at access openings at walls and ceilings indicated or required by building code to be fire-rated.

C. Related Sections:
1. Division 3 Section - "Concrete"
2. Division 4 Section - "Unit Masonry"
3. Division 5 Section – "Cold-Formed Metal Framing."
4. Division 6 Section - "Rough Carpentry"
5. Division 7 Section - "Joint Sealants"
6. Division 9 Section - "Gypsum Board Assemblies"
7. Division 9 Section - "Painting"
8. Divisions 22, 23 and 26 Sections (additional access doors provided and installed by Contractors for Plumbing, Mechanical, Electrical, and related work).

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer’s technical data and installation instructions for each type of access door assembly.
1. Include setting drawings, templates, instructions, and directions for installation of anchorage, devices.
2. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

B. Shop Drawings: Submit drawings showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

1.4 QUALITY ASSURANCE:

A. Single-Source Responsibility: Obtain access doors for entire project from a single

manufacturer and from one source.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

C. Coordination: Furnish inserts and anchoring devices that must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.

1.5 PROJECT CONDITIONS:

A. Verification: Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment, and indicate on submittal schedule.

B. Special-Size Access Doors: Use where required or requested; indicate on schedule.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/PRODUCTS:

A. Acceptable Manufacturers; subject to compliance with requirements, provide access doors by one of the following:
1. Cesco Products / Div. Mestik, Inc.
2. J.L. Industries, Inc.
3. Karp Associates, Inc.
4. Larsens Manufacturing Co.
5. Milcor / Hart & Cooley, Inc.
6. Nystrom, Inc.
7. The Williams Brothers Corp.

2.2 MATERIALS AND FABRICATION:

A. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts, and ready for installation.

B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

C. Frames: Fabricate from 16-gage galvanized steel, or 18-gage stainless steel with No. 4 satin finish, to match doors required at various locations.
1. Fabricate frame with exposed flange, nominal 1-inch wide around perimeter of frame for units installed in the following construction:
a. Exposed masonry.
b. Exposed concrete.
2. For gypsum drywall, furnish perforated flange frames with drywall bead.

D. Painted Flush Panel Doors (non-fire-rated and fire-rated): Fabricate from not less than 16-gage galvanized sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees.

1. Finish with manufacturer's factory-applied prime paint.
2. Restore any damage to galvanized finish with cold-process galvanizing repair paint, prior to applying factory prime coating, or other finishes.

E. Stainless Steel Flush Panel Doors: Fabricate from not less than 18-gage stainless steel sheet, with concealed spring hinges or concealed piano hinge set to open 175 degrees. Buff exposed surfaces to #4 satin finish, except where other finishes are indicated.

F. For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

G. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

H. Finishes:

1. Exterior: Two-coat fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
   a. Coating System Thickness: Minimum 1.2-mil dry film thickness; consisting of 0.3 (±0.1) mil primer and minimum 1.0-mil color coat.
   b. Color: As selected by Architect from manufacturer's full range selection containing not less than fifteen (15) standard colors.
2. Interior, Exposed to Normal View: To match finish of construction to which it is installed.
3. Interior, in Service Areas and Above Ceilings: Factory primed baked enamel.
4. Toilet Rooms, Janitors Rooms, and Break Rooms: Stainless steel, No. 4, satin finish.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Comply with manufacturer's current written instructions and recommendations for installation of access doors.

B. Coordinate installation with work of other trades.

C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.2 ADJUST AND CLEAN:

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior and interior aluminum storefront systems.
2. Exterior and interior aluminum entrance doors.

B. Related Sections:
1. Division 8 Section - "Door Hardware."
2. Division 8 Section - "Glazing."
3. Division 7 Section - "Joint Sealants."

1.3 DESIGN AND PERFORMANCE REQUIREMENTS:

A. System Design Requirements: Manufacturer shall design and provide comprehensive engineering analysis for exterior aluminum-framed entrances and storefront systems complying with specified design and performance requirements

B. System Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
a. Thermal stresses transferring to building structure.
b. Deflection exceeding specified limits.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Glass breakage.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Failure of operating units.

C. Structural Loads: Wind loads and other loads as indicated on Drawings.

D. Deflection of Framing Members: Not less than the following specified limits at design wind pressure.

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13-feet 6-inches and to 1/240 of clear span plus 1/4-inch for spans greater than 13-feet 6-inches or an amount that restricts edge deflection of individual glazing lites to 3/4-inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75-percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8-inch, and minimum 1/16-inch clearance to operable units.

E. Structural Test Performance: Tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150-percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Tested according to ASTM E 283 for infiltration maximum air leakage specified.

1. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
2. Entrance Doors:
   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20-percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

1. No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation shall be permitted.
2. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

H. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. × h × deg F as determined according to NFRC 100.

2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 60 as determined according to NFRC 500.

I. Thermal Movements: Storefront and entrance systems shall be designed to allow for thermal movements resulting from ambient and surface temperature changes as specified.
1. Temperature Change: 120-deg F (67 deg C), ambient; 180-deg F (100 deg C), material surfaces.
2. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and specifications indicating material descriptions, dimensions of individual components and profiles, fabrication methods, finishes, hardware requirements and accessories. Include installation instructions.

B. Shop Drawings: Submit For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Design Analysis: Submit comprehensive engineering analysis for exterior aluminum-framed storefront and entrance systems indicating compliance with specified design and performance requirements.

D. Samples:
1. For Initial Selection: Submit for units with factory-applied color finishes.
2. For Verification: Submit for each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Submit typical vertical-to-horizontal intersection of assembly, made from 12-inch lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.

4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Submit schedule prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Qualification Data: Submit for installer, qualified Professional Engineer and field testing agency to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

H. Energy Performance Certificates: Submit for aluminum-framed storefronts, accessories, and components, from manufacturer. Basis for Certification shall be NFRC-certified energy performance values for each aluminum-framed storefront. (Submit for Architect's information only.)

I. Sealant Compatibility and Adhesion Test Reports: Submit reports from sealant manufacturer indicating that framing materials have been tested for compatibility and adhesion with sealants. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion. (Submit for Architect's information only.)

J. Product Test Reports: Submit reports for aluminum-framed entrances and storefronts based on evaluation of comprehensive tests performed by a qualified testing agency. (Submit for Architect's information only.)

K. Field Quality-Control Reports: Submit inspection and field test reports indicating results of field testing. (Submit for Architect's information only.)

L. Maintenance Data: Submit cleaning and maintenance for aluminum-framed storefront and entrance systems to include in maintenance manuals. Include with closeout submittals.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Installer shall have at least five (5) years' verifiable experience and who has completed installations of aluminum storefront and entrances similar in design and extent to those required for the project with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installation of aluminum-framed storefront and entrance systems that are similar in material, design, and extent to those indicated for this Project. Engineer's service shall include review of shop drawings.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies.

1. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
2. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from a single manufacturer and from a single source.

1.6 MOCK-UPS:

A. Job Mock-Up: Build mock-ups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical storefront wall area at location on building as directed by Architect. Construct at least one full height by width of two glazed panels framed with vertical and horizontal mullions of exterior storefront system.
2. Mock-up shall indicate the following:
   a. Mullion connections.
   b. Structural anchorage.
   c. Steel reinforcing, if required by design.
   d. Framing finish.
   e. Glazing materials.
   f. Flashing and weeping provisions
3. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically approves such deviations in writing.
4. Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion, subject to compliance with requirements.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on shop drawings.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 WARRANTIES:

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration created by wind and thermal and structural movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Water penetration through fixed glazing and framing areas.
   e. Failure of operating components.
2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

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

1. EFCO Corporation.
2. Kawneer North America; an Arconic company.
3. Trulite Glass & Aluminum Solutions, LLC.
4. Tubelite, Inc.
5. United States Aluminum Corp.
6. Vistawall International / Oldcastle Building Envelope Group.
7. YKK AP America Inc.

2.2 MATERIALS:

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Provide as required by manufacturer's engineering analysis.

1. Materials:
   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
2. Finish: Provide with manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

2.3 STOREFRONT FRAMING SYSTEMS:

A. Basis of Design:

1. Exterior Framing System: Kawneer; Trifab VG 451T.
2. Interior Framing System: Kawneer, Trifab 400.
3. Framing systems of similar design and construction by other acceptable manufacturers may be submitted for Architect's acceptance. Acceptance is subject to compliance with specified requirements as evidenced by submittal of manufacturer's product data, test reports and shop drawings.

B. Framing System Design:

1. Exterior Framing Systems: Front set, flush glazed tubular framing system designed for dry glazing with roll-in top load elastomeric glazing gaskets on all sides. Thermal broken framing construction fabricated to accept insulated glass units.
2. Interior Framing System: Center set, flush glazed tubular framing system designed for dry glazing with roll-in top load elastomeric glazing gaskets on all sides. Non-thermal construction fabricated to accept single pane glass units.

C. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Member Sizes:
   a. Exterior Framing Systems: 2-inch face width by 4-1/2 inch depth.
   b. Interior Framing System: 1-3/4 inch face width by 4-inch depth.
2. Thermal Barrier: Manufacturer's thermal break for exterior framing members consisting of a two-part chemical cured, high-density polyurethane material attached to aluminum framing by mechanical and adhesive joining methods.
3. Assembly Method: Shear–block or head-and-sill-receptor system with shear-blocks at intermediate horizontal members.
4. Finish: Color anodized finish as specified.

D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

F. Head Deflection Receptors: Manufacturer's standard receptors at heads designed to compensate for excessive deflection of structure. Provide as required by manufacturer's engineering analysis for job conditions as indicated on final reviewed shop drawings.

G. Sill Flashing or Receptor: Fabricated from minimum 0.062-inch thickness aluminum; matching storefront framing finish of type with interior legs turned up minimum 1-inch against framing member and with end dams to form watertight gutter. Seal all aluminum to aluminum laps with sealant.

H. Trim and Closures: Provide exterior and interior trim and closure components in materials and finishes matching storefront framing for complete installation. Trim components shall be attached without use of exposed fasteners.

I. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 ENTRANCE DOOR SYSTEMS:

A. Entrance Doors: Manufacturer's standard glazed entrance doors of design indicated for manual-swing operation.
   1. Door Design: Wide stile, swing doors.
   2. Stiles and Rails: Dimensions indicated are nominal sizes.
      a. Stiles: 5-inches width.
      b. Top rail: 5-inches width.
      c. Bottom rail: 10-inches width.
   3. Door Construction: 1-3/4 inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide infill adapters to accept insulated glazing for exterior entrances.
      b. Provide non-removable glazing stops on exterior side of door.

B. Entrance Door Hardware: As specified in Division 8 Section "Door Hardware".

C. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
   2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.5 GLAZING SYSTEMS:

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, black, resilient elastomeric glazing gaskets designed to maintain uniform pressure and watertight seal.

C. Setting Blocks and Spacers: Manufacturer's standard elastomeric types.

D. Glazing Sealants: Comply with Division 8 Section "Glazing."

2.6 ACCESSORIES:

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Fasteners shall be concealed to the greatest extent practicable. Where exposed fasteners are required, use type with countersunk Phillips screw heads**,** finished to match framing system. Limit exposed fasteners only to locations indicated on final reviewed shop drawings.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1-inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION:

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from [exterior] [interior] [interior for vision glass and exterior for spandrel glazing or metal panels].
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for framing assembly method specified.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. Provide compression weather stripping at fixed stops at exterior doors,
2. Provide silencers at stops to prevent metal-to-metal contact at interior doors. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. Provide sliding-type weather stripping retained in adjustable strip and mortised into door edge at pairs of exterior doors.
2. Provide weather sweeps applied to door bottoms at exterior doors.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.8 ALUMINUM FINISHES:

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Exterior and Interior Storefront Systems and Entrances: Color anodized finish complying with AAMA 611; AA-M12C22A42/A44, Class I.
1. Coating Thickness: Minimum 0.70 mils (0.018 mm).
2. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION:

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

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.
   1. Do not install damaged components.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   5. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Division 8 - "Glazing."

F. Install perimeter joint sealants as specified in Division 7 Section -"Joint Sealants." Caulk both exterior and interior faces around perimeter of storefront framing with specified sealant.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points. Install door units to prepared openings level and plumb, anchored secured in position and without distortion.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8-inch in 10-feet; 1/4-inch in 40-feet.
2. Level: 1/8-inch in 20-feet; 1/4-inch in 40-feet.
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch wide, limit offset from true alignment to 1/16-inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1-inch wide, limit offset from true alignment to 1/8-inch.
   c. Where surfaces are separated by reveal or protruding element of 1-inch wide or more, limit offset from true alignment to 1/4-inch.
4. Location: Limit variation from plane to 1/8-inch in 12-feet; 1/2-inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform field quality-control tests and inspections, including preparing reports.

B. Water-Spray Test: Before installation of interior finishes has begun, representative areas of aluminum-framed entrances and storefronts designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

1. Test Area: Perform tests on minimum area of at least 10 feet length, by one story of aluminum storefront system.
2. Perform test in areas as directed by Architect.
3. Test shall be performed in the presence of the Architect.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

1. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports for submittal to Architect.

3.5 ADJUSTING AND CLEANING:

A. Entrance Door Adjustments:

1. Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
2. Adjust installed weatherstripping to provide weathertight seal around perimeter of door opening.

3. Doors accessible to people with disabilities, shall have closers adjusted to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3-inches from the latch measured to the leading door edge.

B. General Cleaning: Maintain aluminum storefront assembly in clean condition during construction period. Immediately remove stains or materials having adverse effect on storefront materials and finishes. Remove excess glazing and sealant compounds.

C. Final Cleaning: Just prior to Date of Substantial Completion, clean entire storefront assembly and each exposed face side of metal framing.

1. Clean using pre-tested detergent and water. Flush with clean water.
2. Repair or replace work which cannot be cleaned or which has been damaged during construction operations.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.

4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

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

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

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

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

1.4 QUALITY ASSURANCE

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

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

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

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

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

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

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

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

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

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

   a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

   a. Pemko (PE).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. McKinney (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:

    a. Rockwood (RO).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

1. Manufacturers:

    a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA)

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).

3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 8800FL Series.

2.1 INTEGRATED WIRED OUTPUT LOCKING DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
2. Integrated reader supports the following credentials:

a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
e. NFC-enabled mobile phones
f. PIN code only or PIN + credential with keypad option.

3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.
6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
8. Manufacturers:

    a. Sargent Manufacturing (SA) - SN200/SN210 8200 Series.

2.2 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.3 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

    a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    c. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
    d. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
    e. Five-year limited warranty for mechanical features.

2. Electromechanical exit devices shall have the following functions and features:

    a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
    b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
    c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
    d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.

e. Five-year limited warranty for electromechanical features.

3. Manufacturers:

a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 7000 Series.

C. Extruded Aluminum Removable Mullions: ANSI/BHMA A156.3 anodized, removable mullions with malleable-iron top and bottom retainers. Mullions to be provided standard with stabilizers and imbedded weatherstrip.

1. Manufacturers:

a. Same as exit device manufacturer.

D. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.

1. Provide mullions with functions and features as follows:

a. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturer's certified mullion and accessories to meet applicable state and local windstorm codes.
b. Provide keyed removable feature where specified in the Hardware Sets.
c. Provide stabilizers and mounting brackets as required.
d. Provide electrical quick connection wiring options as specified in the hardware sets.

2. Manufacturers:

a. Same as exit device manufacturer.

2.4 INTEGRATED WIRED OUTPUT EXIT DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated card reader with or without keypad option, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:

a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.

b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
e. NFC-enabled mobile phones
f. PIN code only or PIN + credential with keypad option

3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
6. Manufacturers:

a. Sargent Manufacturing (SA) - SN200/SN210 80 Series.

2.5 DOOR CLOSERS

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

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Manufacturers:

    a. Norton Rixson (NO) - 8500 Series.

2.6 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:

    a. Rockwood (RO).

2.7 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood (RO).

2.8 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and

provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

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

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

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

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

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

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

F. Manufacturers:

1. Pemko (PE).

2.9 ELECTRONIC ACCESSORIES

A. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Manufacturers:

a. Securitron (SU) - AQL Series.

2.10 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.11 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

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

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

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

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. YA - ASSA ABLOY ACCENTRA, formerly known as Yale
5. SA - SARGENT
6. RO - Rockwood
7. NO - Norton

Hardware Sets

Set: 1.0

Doors: 106B, 106C

2	Continuous Hinge	CFM__HD1 - DOOR HEIGHT		PE
1	Mullion	KRM200 - DOOR HEIGHT	600	YA
1	Rim Exit Device, Nightlatch	7105 121NL Temp Core-6 pin	630	YA
1	Rim Exit Device, Exit Only	7105 EO Temp Core-6 pin	630	YA
3	Core	1210	626	YA

1	Mortise Cylinder	2196	626	YA
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	CPS8501	689	NO
2	Kick Plate	K1050 10" CSK	US32D	RO
2	Astragal (Split)	297AS		PE
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Gasketing (Mullion)	5110BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Set: 2.0

Doors: 109, 117B, 119

1	Continuous Hinge	CFM__HD1 - DOOR HEIGHT		PE
1	Storeroom or Closet Lock	AUR8 8805FL Temp Core-6 pin	626	YA
1	Core	1210	626	YA
1	Surface Closer	CPS8501	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Rain Guard	346C		PE
1	Gasketing (Head/Jambs)	S773BL		PE
1	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE

Set: 3.0

Doors: 124

2	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Hinge	TA2714-QC12	US26D	MK
1	Access Control Mort Lock	IDP SN200-82271-24V BIKPS-0E LNL LC	US26D	SA
1	Mortise Cylinder	2196	626	YA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US26D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Power Supply	AQLxx-R8E1		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
• Electronic Operation: Valid card or code unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with card reader, door position switch, and request to exit.

Set: 4.0

Doors: 106A

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Hinge (heavy weight)	T4A3786-QC12	US26D	MK
1	Rim Exit Device	56-SN200-8804 BIKPS-0E ETL LC	US32D	SA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US26D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Power Supply	AQLxx-R8E1		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
•Electronic Operation: Valid card or code unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with card reader, door position switch, and request to exit.

Set: 5.0

Doors: 115, 118, 120, 123

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	AUR 8808FL Temp Core-6 pin	626	YA
1	Core	1210	626	YA
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 6.0

Doors: 104, 108, 113

3	Hinge, Full Mortise	TA2714	US26D	MK

1	Storeroom or Closet Lock	AUR8 8805FL Temp Core-6 pin	626	YA
1	Core	1210	626	YA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 7.0

Doors: 116, 117A, 121, 122

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office Lock	AUR 8807FL Temp Core-6 pin	626	YA
1	Core	1210	626	YA
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 8.0

Doors: 114

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	AUR 8808FL Temp Core-6 pin	626	YA
1	Core	1210	626	YA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 9.0

Doors: 110

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Bathroom Lock	AUR 8862FL V21	626	YA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Coat Hook	RM802	US32D	RO

Set: 10.0

Doors: 100C, 111

2	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Hinge	TA2714-QC12	US26D	MK
1	Access Control Mort Lock	IDP SN200-82271-24V BIKPS-0E LNL LC	US26D	SA
1	Mortise Cylinder	2196	626	YA
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US26D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO
1	Frame Harness	QC-C1500P		MK
1	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Power Supply	AQLxx-R8E1		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Electronic Operation: Valid card or code unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with card reader, door position switch, and request to exit.

Set: 11.0

Doors: 102, 103

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Door Pull	RM3300-13 Mtg-Type 1	US32D	RO
1	Push Plate	70C	US32D	RO
1	Surface Closer	R/PR 8501 (TO SUIT)	689	NO
1	Kick Plate	K1050 10" CSK	US32D	RO
1	Mop Plate	K1050 4" CSK	US32D	RO
1	Door Stop	403/441CU (TO SUIT)	US26D	RO
3	Silencer	608/609 (TO SUIT)		RO

Set: 12.0

Doors: 100A, 100B

2	Continuous Hinge	CFM__SLF-HD1 PT - DOOR HEIGHT		PE
2	Electric Power Transfer	EL-CEPT	630	SU
1	Mullion	L980S- DOOR HEIGHT	PC	SA

1	Rim Exit Device, Dummy	55 8810	US32D	SA
1	Rim Exit Device	56-SN200-8804 BIKPS-0E ETL LC	US32D	SA
1	Mortise Cylinder	2196	626	YA
1	Rim Cylinder	1193	626	YA
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO
2	Surface Closer	CPS8501	689	NO
1	Rain Guard	346C		PE
1	Gasketing (Mullion)	5110BL		PE
2	Sweep (w/ drip edge)	3452CNB		PE
1	Threshold	252x3AFG MSES25SS		PE
2	Frame Harness	QC-C1500P		MK
2	Door Harness	QC-CXXX- LENGTH TO SUIT		MK
1	Card Reader	BY SECURITY SUPPLIER		
2	Position Switch	DPS-M/W-BK (TO SUIT)		SU
1	Power Supply	AQLxx-R8E1		SU
1	Wiring Diagram	Elevation and Point to Point as Specified		

Notes:
• Perimeter/meeting stile seals by frame/door supplier.
•Electronic Operation: Valid card or code unlocks outside lever or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched. Lock included with card reader, door position switch, and request to exit.

END OF SECTION 087100

SECTION 088000

GLAZING

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. Glazing for installation to the following:
      a. Aluminum storefronts systems including entrances.
      b. Aluminum curtain wall systems including entrances.
      c. Hollow metal doors and frames.
      d. Wood doors.
   2. Glazing accessories.

B. Extent of glass and glazing work is indicated on drawings and schedules.

C. Related Sections:
   1. Division 7 Section – "Joint Sealants."
   2. Division 8 Section – "Hollow Metal Doors and Frames."
   3. Division 8 Section – "Flush Wood Doors."
   4. Division 8 Section – "Aluminum-Framed Entrances and Storefronts."
   5. Division 8 Section – "Sliding Automatic Entrances"

1.3 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Wind Loads: Comply with wind load design requirements specified in Division 8 Section "Aluminum-Framed Entrances and Storefronts."

B. Thermal Insulating Units: Units shall comply with the requirements of ASTM E2190-19 and certified by Insulating Glass Certification Council (IGCC) or Associated Laboratories, Inc. (ALI).

C. Tinted, Low-E, Thermal Insulating Glass Performance Characteristics: Values indicated based on *PPG Solarban 60 on Solargray;* 1-inch thickness insulated unit with 1/4-inch thickness lites; coating applied to #2 surface.
   1. Thermal Transmittance ("U" value winter night): 0.29.
   2. Solar Heat Gain Coefficient(SHGC): 0.25.
   3. Visible Light Transmittance: 35-percent.

D. Tempered Glazing Materials: Complying with CPSC 16-CFR, Part 1201, Category II.

E. Fire-Rated Glazing: Complying with NFPA 80-2020 and specified fire testing and safety glazing requirements.

1. Fire-rated glazing installed in fire window and door assemblies shall be of materials identical to those passing fire tests complying with the following:

a. Door Assemblies:

1) NFPA 252-2022, "Standard Methods of Fire Tests of Door Assemblies," or ASTM E2074-00e1, "Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies."

2) UL 10B-2020, "Standard for Fire Tests of Door Assemblies."

3) UL 10C-2016, "Standard for Positive Pressure Fire Tests of Door Assemblies."

b. Window Assemblies:

1) UL 9-2020, "Standard for Fire Tests of Window Assemblies."

2. Fire-rated glazing installed in framed assemblies used as fire barriers shall be of materials identical to those passing fire tests complying with the following.

a. ASTM E119-22, "Standard Test Methods for Fire Tests of Building Construction and Materials," or NFPA 251-2006, "Standard Methods of Tests of Fire Resistance of Building Construction and Materials.

3. Fire rated glazing materials shall meet safety glazing requirements complying CPSC 16-CFR, Part 1201, Category II.

4. Fire rated glazing shall be Classified or Listed by Underwriters Laboratories (UL) or Intertek Warnock Hersey (WHI) for ratings indicated.

F. Heat Treatment: Glazing materials, whether in monolithic state or as a lite of a thermal insulating unit, shall be heat treated where required by glass manufacturer's design calculations to resist stress caused by glass orientations, sizes and configurations, heat stress, inherent imperfections, wind loading, glazing conditions, temperature differential, inside window treatments or other conditions affecting breakage probability. Maximum allowable breakage probability at design loads shall be eight (8) lites per thousand for vertical glazing.

G. Glazing Orientation for Heat-Treated Glass: Orient lites with roll distortion parallel to head and sill members.

1.4 SUBMITTALS:

A. Product Data:

1. Submit for each type glazing material and accessory product specified; indicating performance characteristics.

2. Include technical data and instructions for storage and handling procedures.

B. Framing Manufacturer's Approval: Indicate by letter prior to submission of shop drawings for storefront system that an authorized representative of selected storefront manufacturer has reviewed and approved details, including glass bite, clearances and glazing methods.

C. Samples: Submit minimum 12-inch (1'-0") by 12-inch (1'-0") samples of each type of glazing material proposed for use, if requested by Architect.

D. Glass Design Calculations: Submit calculations prepared by glazing material manufacturer indicating recommendations for glass thickness and heat treating of glazing materials as a result of heat stress, building orientation, inside window treatments, shading by exterior building elements or wind loading.

1. Identify factors affecting breakage probability which have been taken into consideration and anticipated by calculations.
2. Calculations are submitted for Architect's information only.

E. Maintenance Data: Include glazing material manufacturer's maintenance data for cleaning and care of each type of glazing material. Submit as part of contract closeout documents.

1.5 QUALITY ASSURANCE:

A. Single Source Requirements: Tinted and low emissivity (Low-E) glass types, whether used in a monolithic state or as a lite of a thermal insulating unit, shall each be the products of a single manufacturer.

B. Labels:

1. Glazing shall bear manufacturer's label identifying type, quality and thickness of material. Labels for single thickness annealed float glass, if not available on each lite shall at least be factory applied to shipping crates. All other glazing materials shall be required to bear labels on each lite either temporary or permanent types as required by governing building codes or certification agency where specified.
2. Tempered glass shall have permanent etched or ceramic fired identification on each unit indicating compliance with safety glazing standard. Identification shall be visible in completed installation and oriented in an inconspicuous corner.

1.6 PRE-GLAZING CONFERENCE:

A. Prior to beginning glass and glazing work, a pre-glazing conference will be held to review work to be accomplished.

B. Contractor, storefront and fire-rated storefront supplier and erector, a representative of glass manufacturer, including fire-rated glass manufacturer, a representative of sealant manufacturer, glazing subcontractor and Architect will be present.

C. Contractor shall notify Architect at least three days prior to time of conference.

D. Material submitted by Contractor, interfacing of glass and glazing and storefront work, dimensions and tolerances, sealant joint widths and depths will be reviewed.

1.7 DELIVERY, STORAGE AND HANDLING:

A. Deliver glazing materials with manufacturer's identification, glass type, thickness and quality labeled on each piece. Remove no labels until final cleaning.

B. Store glazing materials indoors in cool, dry area, off floor, equally supported to prevent stress and breakage.

C. Do not move cases which have been partially unpacked. Unpack glazing materials in accordance with manufacturer's product data for type of material being handled. Stack individual lites as recommended by manufacturer's product data.

D. Utilize rolling blocks to rotate glazing materials.

E. Handle insulating units without rotating, warping or "cartwheeling" units. Prevent damage to glazing material or edge seal.

1.8 WARRANTIES:

A. Thermal Insulating Units: Warrant from failure due to loss of edge seal for a period of Ten (10) Years, beginning at Date of Substantial Completion.

B. Low Emissivity (Low-E) Glass: Low emissivity coating shall be warranted against peeling, cracking, discoloration or deterioration for a period of Ten (10) Years, beginning at Date of Substantial Completion.

C. Glass Replacement Warranty: Provide warranty covering replacement of damaged glazing materials for any reason other than natural disasters, vandalism or damage resulting from accident or abuse arising out of the Owner's operations for a period of Two (2) Years, beginning at Date of Substantial Completion. Warranty shall include labor and material costs for replacement of glazing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Float Glass Manufacturers; subject to compliance with specified requirements:
1. AGC Glass Company North America, Inc.
2. Guardian Industries Corp.
3. Pilkington NA / Nippon Sheet Glass Company Ltd.
4. PPG lndustries, Inc.
5. Viracon, Inc.

B. Acceptable Coated Glass Manufacturers; subject to compliance with specified requirements:
1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries, Inc.
3. Guardian Industries Corp.
4. Pilkington NA / Nippon Sheet Glass Company Ltd.
5. PPG Industries, Inc.
6. Viracon, Inc.

C. Acceptable Insulating Glass Unit Fabricators; subject to compliance with specified requirements:
1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries, Inc.

3. Guardian Industries Corp.
4. Oldcastle BuildingEnvelope / Oldcastle, Inc.
5. Pilkington NA / Nippon Sheet Glass Company Ltd.
6. Viracon, Inc.

D. Acceptable Fire-Rated Glass Manufacturers; subject to compliance with specified requirements:
1. AGC InterEdge Technologies, LLC / AGC Glass Company NA, Inc.
2. Nippon Electric Glass Company, Ltd. / Technical Glass Products.
3. Pilkington NA / Nippon Sheet Glass Company Ltd.
4. SAFTI First / Div. O'keeffe, Inc.
5. J.R Four, Ltd. / Technical Glass Products.
6. VETROTECH Saint-Gobain NA.

2.2 PRIMARY AND PROCESSED GLAZING MATERIALS:

A. Clear Float Glass: Meeting ASTM C1036, Type I, Class 1 (clear), Quality q3 (glazing select); minimum 1/4-inch thickness, or as determined by glazing manufacturer's analysis.

B. Heat-Strengthened Clear Float Glass: Meeting ASTM C 1048, Type I, (transparent), Class 1 (Clear), Quality q3 (Glazing Select), Kind HS (Heated Strengthened), Condition A (Uncoated Glass); thickness as specified or as determined by glazing manufacturer's analysis.

C. Tempered, Clear Float Glass: Meeting ASTM C 1048, Kind FT (fully tempered), Condition A, Type I, Class 1 (clear), Quality q^3 (glazing select); minimum 1/4-inch thickness, except as otherwise indicated.

D. Tinted, Low-E Float Glass:
1. Basis of Design: PPG Industries, Inc.; Solarban 60 on Solargray.
2. Material:: Low emissivity, pyrolytic-coated or sputter-coated, tinted, annealed, tempered or heat strengthened float glass meeting specified ASTM standards indicated and as determined by glazing manufacturer's analysis for application required.
   a. Heat Strengthen, Float Glass: Meeting ASTM C1048, Kind HS (heat strengthen), Condition C, Type I, Class 2 (tinted), Quality q3 (Glazing Select).
   b. Tempered, Float Glass: Meeting ASTM C1048, Kind FT (fully tempered), Condition C, Type I, Class 2 (tinted), Quality q3 (Glazing Select).
3. Thickness: As determined by glazing manufacturer's analysis.
4. Color: Gray.

2.3 FABRICATED GLAZING UNITS:

A. Butt Joint Glazing Units: Tempered, clear float glass meeting ASTM C 1048, Kind FT (fully tempered), Condition A, Type I, Class 1 (clear), Quality q^3 (glazing select;), tested

for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.

1. Thickness: 3/8-inch.
2. Butt Edges: Flat ground to produce square edges with slight chamfers at junctions of edges and faces.

B. Tinted, Low-E, Thermal Insulating Units:

1. Basis of Design: PPG Industries, Inc.; Solarban 60 on Solargray + clear glass.
2. Outboard Lite: Tinted, low-E, heat strengthen, float glass as specified; thickness as determined by glazing manufacturer's analysis. Low-E coating applied to No. 2 surface.
3. Inboard Lite: Clear, heat strengthen float glass as specified; thickness as determined by glazing manufacturer's analysis.
4. Spacer: Manufacturer's standard steel or aluminum spacer with welded, fused or bent corners and welded or fused splices and joints, filled with desiccant; to provide a 1/2-inch thickness, hermetically sealed, dehydrated air space.
5. Unit Thickness: 1-inch, minimum.

C. Tempered, Tinted, Low-E, Thermal Insulating Units:

1. Basis of Design: PPG Industries, Inc.; Solarban 60 on Solargray + clear glass.
2. Outboard Lite: Tempered, tinted, low-E, float glass as specified; thickness as determined by glazing manufacturer's analysis. Low-E coating applied to No. 2 surface.
3. Inboard Lite: Tempered, clear float glass as specified; thickness as determined by glazing manufacturer's analysis.
4. Spacer: Manufacturer's standard steel or aluminum spacer with welded, fused or bent corners and welded or fused splices and joints, filled with desiccant; to provide a 1/2-inch thickness, hermetically sealed, dehydrated air space.
5. Unit Thickness: 1-inch, minimum.

D. Obscure, Tinted, Low-E, Thermal Insulating Units:

1. Basis of Design: PPG Industries, Inc.; Solarban 60 on Solargray + decorative obscure glass.
2. Outboard Lite: Tinted, low-E, heat strengthen, float glass as specified; thickness as determined by glazing manufacturer's analysis. Low-E coating applied to No. 2 surface.
3. Inboard Lite: Heat strengthen, decorative obscure glass as specified; thickness as determined by glazing manufacturer's analysis.
4. Spacer: Manufacturer's standard steel or aluminum spacer with welded, fused or bent corners and welded or fused splices and joints, filled with desiccant; to provide a 1/2-inch thickness, hermetically sealed, dehydrated air space.
5. Unit Thickness: 1-inch, minimum.

2.4 GLAZING ACCESSORIES:

A. Setting Blocks: Neoprene, 70-90 Shore A durometer hardness, meeting ASTM C 864.

B. Edge Blocks: Neoprene, 60-70 Shore A durometer hardness, meeting ASTM C 864.

C. Spacers: Neoprene, 40-60 Shore A durometer hardness, meeting ASTM C 864.

D. Glazing Gaskets for Storefront Systems: Glazing assembly manufacturer's standard extruded or molded neoprene or Ethylene Propylene Diene Monomer (EPDM) gaskets.

E. Interior Hollow Metal Partition Glazing: Manufacturer's standard resilient glazing beads.

F. Polyvinyl Chloride Foam Tape: Closed cell foam tape meeting ASTM D1667-05 with pressure-sensitive adhesive on one side.

G. Fire-Rated Glazing Accessories:

1. Glazing Gaskets and Tapes: Closed cell polyvinyl chloride (PVC) foam tape, EPDM tape, ceramic glazing tape or other flame resistant gasket material as recommended by fire-rated glazing manufacturer and fire tested with glazing assemblies for specified ratings.
2. Setting Blocks: Neoprene, EPDM, hardwood or calcium silicate setting blocks as recommended by fire-rated glazing manufacturer and fire tested with glazing assemblies for specified ratings.
3. Cleaners, Primers and Sealers: Types as recommended by glazing and gaskets manufacturer.

2.5 GLAZING SEALANT:

A. Acceptable Products; subject to compliance with specified requirements:

1. Dow Corning Corp.; 795 Silicone Building Sealant.
2. Pecora Corp.; 895NST.
3. Tremco, Inc.; Spectrum 2.

B. Characteristics: One part, neutral-curing silicone rubber glazing sealant complying with ASTM C920-05, Type S, Grade NS, Class 50, Use NT.

1. Joint Movement Capability: Minimum plus or minus 50-percent extension and compression.
2. Colors: As selected by Architect from manufacturer's standard full range color selection.

C. Accessories: Provide primers as required, backer rod and accessories acceptable to sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify compliance with the following requirements prior to beginning glazing work:

1. That framing is anchored in position, plumb and square within 1/8-inch of nominal dimensions indicated.
2. That fastener heads, and other projections are removed from glazing rabbets.
3. That corners and fabricated intersections are sealed and framing is weather-tight.

4. That rabbets at sills weep to outside and rabbets are of sufficient depth and width to receive glazing material and provide the required bite of the glazing material.
5. That wood frames have been prime painted or stained and finished as applicable in accordance with Painting section.
6. That hollow metal frames have received paint finish in accordance with Painting section.

3.2 PREPARATION:

A. Clean glass edges and framing glazing channel of debris and protective coatings immediately prior to glazing. Use material acceptable to framing, glazing material and glazing sealant manufacturers.

B. Inspect glazing material prior to installation. Eliminate lites having face or edge damage.

C. Lites of tempered, heat-strengthened, laminated and insulating glass shall not be cut or otherwise altered in the field.

3.3 INSTALLATION REQUIREMENTS:

A. Install glazing materials to obtain air-tight and water-tight installation and to withstand normal temperature changes and wind loads without failure.

B. Protect glazing material faces and edges during handling and installation.

C. Size glazing materials for each opening to ensure correct bite on glazing material, without imposing strain, in accordance with manufacturer's product data.

D. Maintain minimum 1/8-inch bed clearance between glazing material and sash, on both sides, except where greater clearances is required by either glazing material or framing manufacturer.

3.4 GLAZING INSTALLATION:

A. Install glazing materials in accordance with manufacturer's product data and applicable standards, except where more stringent requirements are specified.

B. Install setting blocks for all glazing materials over six sq. ft. in area.
1. Install at sill rabbet located one quarter of glass width from each corner, but with edge nearest corner not closer than 6-inch from corner, unless otherwise required.
2. Size setting blocks in proportion to glass weight; minimum 4-inch length.

C. Shim all lites over 100 united inches, inboard and outboard, on all sides using continuous shims, except where gaskets accomplish shimming; unless otherwise specified.

D. Provide edge blocks at vertical jambs to limit lateral movement of glass. Provide edge blocks in 4-inch minimum lengths. Maintain 1/8-inch clearance between edge of glass and edge block.

E. Storefront Glazing:

1. Install continuous gasket to exterior side of rabbet with joints located at center and top of frame. Notch gasket at corners to form neat joints.
2. Set glazing material centered in rabbet. Apply gaskets to interior side of rabbet, with corners mitered.
3. Oversize gaskets to allow compressing of miter joints to provide positive seal.

F. Curtain Wall Glazing:

1. Install gasket to interior stop with mitered corners.
2. Set glazing material centered in rabbet. Apply exterior gasket, with corners mitered.
3. Oversize gaskets to allow compressing of miter joints to provide positive seal.

G. Interior Hollow Metal Partition Glazing: Glaze using specified glazing beads in accordance with manufacturer's instructions.

H. Interior Channel Glazing: Glaze using specified polyvinyl chloride foam tape applied to both sides of glazing pocket. Install tape with tight butted joints. Compress tape approximately 30-percent. Set glazing material centered in rabbet.

I. Interior Vertical Butt Joint Glazing: Set glazing units with uniform joints plumb and with glass edges aligned. Install glazing with 3/8-inch, maximum, butt joint width complying with GANA recommendations unless otherwise directed by sealant manufacturer's requirements.

1. Seal vertical butt joint conditions using clear silicone glazing sealant. Comply with glazing material manufacturer's product data and recommendations for joint width and depth.
   a. Mask edges of glass to confine sealant to joints and to avoid contact to face of glazing.
   b. Tool sealant joints neat to provided slight concave surface using tool agent recommended by sealant manufacturer.
2. After tooled sealant joints have set, remove masking from glass and clean surfaces free of sealant material.

J. Fire-Rated Glazing: Comply with fire-rated glazing manufacturer's instructions and NFPA 80 requirements for installation in fire doors and windows or framed openings.

1. Install glazing materials of ratings scheduled for fire-rated doors and framed openings.
2. Install glazing so that permanent labels are positioned in an inconspicuous corner for visual inspection by building official.

K. Glazing Sealant Installation: Comply with applicable provisions of Division 7 "Joint Sealants" section. Prevent filling of weep holes with sealant.

3.5 PROTECTION AND CLEANING:

A. For glazing materials subject to damage during construction, protect from breakage by attachment of crossed streamers to framing. Do not mark on surfaces.

B. Remove and replace broken, cracked, chipped or otherwise damaged glazing materials and materials not meeting specified design requirements prior to Date of Substantial Completion.

C. Final cleaning: Just prior to Date of Substantial Completion, clean glass inside and out.

1. Clean using pre-tested detergent and water. Flush with clean water.
2. Repair or replace work which cannot be cleaned or which has been damaged during construction operations.

END OF GLAZING

SECTION 092116

NON-STRUCTURAL METAL FRAMING

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. Nonload-bearing steel framing members for interior gypsum board assemblies.
   2. Gypsum board attached to steel framing including the following board types:
      a. Regular gypsum board.
      b. Sag-resistant gypsum ceiling board.
      c. Moisture and mold-resistant gypsum board.
      d. Glass-mat, water-resistant gypsum backing board.
   3. Suspended drywall furring system.
   4. Sound Insulation.

B. Related Sections:
   1. Division 5 Section - "Cold-Formed Metal Framing."
   2. Division 6 Section - "Rough Carpentry."
   3. Division 7 Section – "Firestopping."
   4. Division 8 Section – Hollow Metal Doors and Frames.
   5. Division 8 Section – "Access Doors and Frames."
   6. Division 9 Section – "Acoustical Panel Ceilings"
   7. Division 9 Section – "Tiling."
   8. Division 9 Section - "Painting."
   9. Division 22 – Plumbing sections.
   10. Division 23 - Heating, Ventilating, and Air Conditioning sections.
   11. Division 23 – Electrical sections.

1.3 DEFINITIONS:

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Nonload-Bearing Steel Framing Members: Framing for interior gypsum board assemblies shall be in accord with manufacturer's product data for heights and conditions of use complying with the following maximum allowable deflection.

1. Framing supporting gypsum board receiving paint, wallcovering or similar flexible finishes: L/240.
2. Framing supporting gypsum board or cement board receiving ceramic tile, adhered stone veneer, plaster, and similar rigid finishes: L/360.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer's product literature, including installation instructions, indicating compliance with specified requirements.
1. Mark literature to indicate only those products proposed for use.
2. Include data for fire-rated and sound-rated partitions. Include details for acoustical sealant installation.
3. Include technical data and manufacturer's details for shaftwall system.
4. Include technical data and manufacturer's details for suspended drywall furring system.

B. Product Certificates: Submit certification signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.6 QUALITY ASSURANCE:

A. Single-Source Limitations:
1. Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.
2. Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
3. Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.8 PROJECT CONDITIONS:

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures:

1. For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C).
2. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry.
3. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with requirements, provide products for each of the indicated materials by one of the listed manufacturers:
1. Steel Framing and Furring:
a. CEMCO / California Expanded Metal Products Co.
b. ClarkDietrich Building Systems, LLC.
c. Marino Ware / Div. Ware Industries, Inc.
d. The Steel Network, Inc.
2. Gypsum Board and Related Products:
a. CertainTeed Corporation.
b. G-P Gypsum Corporation / Georgia-Pacific Company.
c. Continental Building Products, Inc.
d. National Gypsum Company.
e. USG Corporation.

2.2 STEEL FRAMING FOR INTERIOR WALLS, PARTITIONS AND SOFFITS:

A. Metal Finish for Framing : Provide steel framing members with protective finish complying with the following requirements:
1. Manufacturer's standard corrosion-resistant coating for interior applications except as otherwise specified.
2. Protective coating meeting ASTM A 653, G 40 hot-dip galvanized coating for framing members attached to and within 10-feet of exterior walls and where supporting ceramic tile finishes.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch wide minimum lip (return), and complying with the following requirements:
1. Thickness: Provide minimum thickness of base (uncoated) metal as specified below.
a. 0.0179 inch (25 gauge), minimum, unless otherwise indicated.
b. 0.0329 inch (20 gauge) minimum, for applications as follows:
1) For head runner, sill runner, jamb, and cripple studs at door and

other openings.

2) In locations to receive abuse-resistant gypsum board.

3) In locations to receive glass-mat, water-resistant, gypsum backing board for tile finishes.

4) In locations to receive cementitious backer board for adhered stone masonry veneer finishes.

2. Depth: 3-5/8 inches, minimum, unless otherwise indicated.

C. Deflection Tracks: Either of the following types specified fabricated from runners meeting ASTM C 645.

1. Single Long-Leg Runner System: Top runner with 2-inch deep flanges fabricated from same material as studs, minimum 0.0329-inch (20-gauge) thickness, installed with studs friction fit into top runner and with continuous bridging located within 12-inches of the top of studs to provide lateral bracing.

2. Double-Runner System: Nested top runners fabricated from same material as studs with inner runners having 2-inch deep flanges, minimum 0.0269-inch (22-gauge); outer runner sized to friction fit over inner runner fastened to studs.

D. Steel Rigid Furring Channels: ASTM C 645, hat shaped section, complying with the following requirements:

1. Thickness: 0.0179 inch (25 gauge) minimum base (uncoated) metal thickness, unless otherwise indicated.

2. Depth: 7/8 inch unless otherwise indicated.

E. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch (25 gauge), and depth required to fit insulation thickness or as indicated.

F. Steel Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet complying with ASTM A 653 or ASTM A 568 to form 1/2-inch deep channel of the following configurations:

1. Single-Leg Configuration: Asymmetric-shaped channel with face connected to a single flange by a single-slotted leg (web); 1-1/2 inch face width.

2. Double-Leg Configuration: Hat-shaped channel, with 1-1/2 inch wide face connected to flanges by double-slotted or expanded-metal legs (webs).

G. Steel Channel Bridging: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, 1-1/2 inches deep, 475 lb/1000 lineal feet, unless otherwise indicated.

H. Steel Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A 653 or ASTM A 568, length and width as indicated; 0.0598-inch (16 gauge) minimum base metal (uncoated) thickness.

2.3 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS:

A. General: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.

B. Cast-in-Place and Post installed Anchors in Concrete: Anchors of type indicated below,

fabricated from corrosion-resistant materials, with holes or loops for attaching hanger wires, and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.

1. Cast-in-place type designed for attachment to concrete forms.
2. Expansion anchor.

C. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190 conducted by a qualified independent testing agency.

D. Wire Ties: ASTM A 641, Class 1 zinc coating, soft temper, 0.062 inch thick.

E. Wire Hangers For Interior Ceilings: ASTM A 641, Class 1 zinc coating, soft temper, 0.162-inch diameter.

F. Rod Hangers: Minimum 1/4-inch diameter, galvanized, threaded cold-drawn mild steel.

G. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, and as follows:

1. Carrying Channels: 2 inches deep, 590 lb/1000 lineal feet, unless otherwise indicated.
2. Furring Channels: 3/4 inch deep, 300 lb/1000 lineal feet, unless otherwise indicated.
3. Finish For Interior Suspension System: Manufacturer’s standard corrosion resistant zinc coating.

H. Steel Studs for Furring Channels: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0329 inch (20 gauge), unless otherwise indicated.
2. Depth: 2-1/2 inches, unless otherwise indicated.
3. Protective Coating: Manufacturer’s standard corrosion-resistant coating unless indicated otherwise.

I. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth of 7/8-inch, and minimum thickness of base (uncoated) metal as follows:

1. Thickness: 0.0329 inch (20 gauge), unless otherwise indicated.
2. Protective Coating: Manufacturer's standard corrosion-resistant coating unless indicated otherwise.

2.4 GYPSUM BOARD PRODUCTS:

A. General:

1. Lengths: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum

board application.

2. Widths: Provide gypsum board in widths of 48-inches.

B. Gypsum Wallboard: Meeting ASTM C 1396 and as follows:

1. Types:

a. Regular Gypsum Board: Provide for vertical surfaces, unless otherwise indicated.

b. Type X or Type C Gypsum Board: Provide as required by fire-resistance-rated assemblies indicated on Drawings.

c. Sag-Resistant Gypsum Ceiling Board: Provide for ceiling applications.

2. Edges: Tapered.

3. Thickness: As indicated on drawings.

C. Moisture and Mold Resistant Gypsum Board: Meeting ASTM C 1396, with moisture- and mold-resistant core and paper surfaces.

1. Mold Resistance: No mold growth when tested per ASTM D 3273 and having a score of 10 as rated according to ASTM D 3274.

2. Long Edges: Tapered.

3. Thickness: As indicated on drawings.

D. Glass-Mat, Water-Resistant Gypsum Backing Board:

1. Acceptable Product; subject to compliance with requirements:

a. CertainTeed Corporation; Diamondback GlasRoc Tile Backer Type X.

b. G-P Gypsum / Georgia Pacific Company; DensShield Fireguard Tile Backer.

c. National Gypsum Company; Gold Bond eXP Tile Backer.

d. United States Gypsum Co.; Durock Brand Glass-Mat Tile Backerboard.

2. Characteristics: Coated glass-mat, water-resistant backing panel complying with ASTM C1178-11; composed of non-combustible, water-resistant, type X special fire resistant gypsum core, surfaced with glass mats and with water-resistant acrylic coating on one surface.

a. Thickness: 5/8-inch; unless otherwise indicated.

b. Size: 48-inches (4-ft.) width by manufacturer's standard lengths.

2.5 TRIM ACCESSORIES:

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal of steel sheet zinc coated by hot-dip process or rolled zinc or plastic:

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.

b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.

c. L-bead with face flange only; face flange formed to receive joint

compound. Use L-bead where indicated.

d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.

e. One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS:

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated. Use pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
3. For filling joints and treating fasteners of glass-mat water-resistant gypsum backing board installed to receive ceramic tile finish, use formulation recommended by glass-mat water-resistant gypsum board manufacturer.
4. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products or ready-mixed formulation complying with the following requirements for intended use.

1. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
2. Topping compound formulated for fill (second) and finish (third) coats.
3. All-purpose compound formulated for both taping and topping compounds.

2.7 ACOUSTICAL JOINT SEALANTS:

A. Acoustical Sealant:

1. Acceptable Products:
   a. Pecora Corp., AIS-919 Acoustical and Insulation Latex Sealant.
   b. Tremco, Inc., Acoustical Sealant.
   c. Specified Technologies, Inc.; SpecSeal Smoke N' Sound Acoustical Caulk.
   d. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
2. Type: Manufacturer's standard nonsag, paintable, nonstaining latex sealant

complying with ASTM C 83.

a. Product shall effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

b. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

2.8 SOUND INSULATION:

A. Mineral Fiber Sound Attenuation Batts:

1. Acceptable Products; subject to compliance with specified requirements:
   a. Fibrex Insulations, Inc.; Sound Attenuation Fire Batt Insulation (SAFB)
   b. IIG MinWool, LLC; MinWool-1200 Sound Attenuation Fire Batt.
   c. Rockwool Manufacturing Co., Delta SA-Fire Board.
   d. Thermafiber, Inc.; Thermafiber Sound Attenuation Fire Blankets (SAFB).
2. Type: Unfaced, mineral fiber blankets meeting ASTM C665, Type I and ASTM C612.
   a. Density: Minimum 2.5 pcf.
   b. Combustibility: Non-combustible when tested in accord with ASTM E136.
   c. Surface burning characteristics: Meeting flame spread and smoke developed index specified when tested in accord with ASTM E84.
   d. Flame spread index: Not less than 15.
   e. Smoke developed index: Not more than 5.
   f. Thickness: As indicated on drawings or as required to meet sound rated assembly design.
   g. Size: Manufacturer's standard widths to friction fit between framing members by lengths as required.

B. Fiberglass Sound Batts:

1. Acceptable Products; subject to compliance with specified requirements:
   a. CertainTeed Corporation; CertaPro AcoustaTherm Batts.
   b. Johns Manville Corporation/Building Insulation Division; Sound Control Batts.
   c. Knauf Insulation; QuietTherm QT Batts.
   d. Owens-Corning Fiberglas Corporation; Sonobatts Insulation.
2. Type: Unfaced, fiberglass blanket insulation meeting ASTM C665, Type I.
   a. Surface burning characteristics: Meeting flame spread and smoke developed index specified when tested in accord with ASTM E84.
      1) Flame spread index: Not less than 25.
      2) Smoke developed index: Not more than 50.
   b. Thickness: As indicated on drawings or as required to meet sound rated assembly design.
   c. Size: Manufacturer's standard width equal to spacing of framing

members.

2.9 MISCELLANEOUS MATERIALS:

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

C. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

D. Fasteners for Gypsum Board:

1. Provide steel drill screws complying with ASTM C 1002 for the following applications:
   a. Fastening gypsum board to steel members less than 0.033-inch thick.
   b. Fastening gypsum board to wood members.
   c. Fastening gypsum board to gypsum board.
2. Provide steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112-inch thick.

E. Laminating Adhesive: Special adhesive or joint compound as recommended by manufacturer for laminating gypsum panels. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates to which gypsum board assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panel products before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

B. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

3.3 STEEL FRAMING INSTALLING, GENERAL:

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with manufacturer’s recommended details.

1. Where building structure abuts ceiling perimeter or penetrates ceiling.
2. Where partition framing and wall furring abut structure, except at floor.

D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.4 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS:

A. Suspend ceiling hangers from building structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure angle, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are

secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or otherwise fail.

5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support. Comply with building code requirements for seismic bracing.

C. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.

1. Wire Hangers: 48 inches on center.
2. Carrying Channels (Main Runners): 48 inches on center.
3. Furring Channels (Furring Members): 16 inches on center.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

3.5 INSTALLING STEEL FRAMING FOR INTERIOR WALLS, PARTITIONS AND SOFFITS:

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8-inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2-inch short of full height to provide perimeter relief.
2. For sound insulated and fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated.

1. Single-Layer Construction: Space studs 16-inches on center, unless otherwise

indicated.

2. Multilayer Construction: Space studs 24-inches on center, unless otherwise indicated.
3. Moisture and Mold Resistant Gypsum Board Construction: Space studs 16-inches on center, unless otherwise indicated.
4. Abuse-Resistant Gypsum Board Construction: Space studs 16-inches on center, unless otherwise indicated.
5. Cement Board Construction: Space studs 16-inches on center, unless otherwise indicated.

F. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

G. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two (2) studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.6 APPLYING AND FINISHING GYPSUM BOARD, GENERAL:

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound insulation , where indicated, prior to installing gypsum panels unless insulation is readily installed after panels have been installed on one side. Refer to the "Sound Insulation" article in this specification section.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

E. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Avoid joints other than control joints at corners of framed openings where possible.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Spot grout hollow metal door frames for solid-core wood doors, hollow metal doors, and doors over 32-inches wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

I. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.

1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-inch to 3/8-inch wide joints to install sealant.

K. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch to 1/2-inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

L. Where sound insulated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

1. Space screws a maximum of 12-inches on center for horizontal applications
2. Space fasteners in panels that are tile substrates a maximum of 8-inches on center.

3.7 GYPSUM BOARD APPLICATION METHODS:

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate

courses of board.

b. At high walls, install panels horizontally.

B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and gypsum wallboard face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints. Stagger joints on opposite sides of partitions.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports fastened with screws.

D. Multilayer Fastening Methods: Apply base layers of gypsum panels and face layer to base layers as follows:

1. At fire rated partitions Fasten both base layers and face layers separately to supports with screws.
2. At all other locations, fasten base layers with screws and face layer with adhesive and supplementary fasteners.

E. Direct-Bonding to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

F. Tile Backing Board Application: Install specified glass-mat, water-resistant gypsum backing board as a substrate to receive ceramic wall tile and similar rigid applied wall finishes. Comply with tile installation method specified in Division 9 Section "Tiling" for metal framing and gypsum backing board.

1. Comply with manufacturer's written installation instructions and install at locations indicated to receive wall tile.
2. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.8 INSTALLING TRIM ACCESSORIES:

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install cornerbead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.

D. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES:

A. Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.

D. Levels of Gypsum Board Finish: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated.

1. Level 1 for ceiling plenum areas and concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies. Embed tape at joints.
2. Level 2 where gypsum board panels form substrates for ceramic tile and where indicated. Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Level 4 for gypsum board to receive flat paint finish, at surfaces that will be exposed to view, and for all other locations not otherwise specified. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.
4. Level 5 for gypsum board to receive gloss or semi-gloss paint finish, including epoxy paints. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface

E. Finish glass-mat water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturer's directions for treatment of joints behind tile.

3.10 SOUND INSULATION:

A. Install to gypsum drywall partitions after first layer of gypsum board is installed.

B. Install sound insulation with snug joints in accord with manufacturer's instructions to secure insulation in place.

C. Where installed above ceilings, lay insulation flat. Install unfaced batts over suspended ceilings at partitions in width that extends on either side of partition as indicated.

3.11 FIELD QUALITY CONTROL:

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed.

1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying Architect, complete the following in areas to receive gypsum

board ceilings:

a. Installation of 80-percent of lighting fixtures, powered for operation.
b. Installation, insulation, and leak and pressure testing of water piping systems.
c. Installation of air duct systems.
d. Installation of air devices.
e. Installation of mechanical system control air tubing.
f. Installation of ceiling support framing.

B. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

3.12 CLEANING AND PROTECTION:

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, or mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 092116

SECTION 093000

TILING

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. Porcelain tiles.
2. Glazed wall tiles.
3. Crack isolation membrane for thin-set tile installations.
4. Tile setting materials and accessories.

B. Related Sections:
1. Division 3 Section - "Cast-In Place Concrete."
2. Division 9 Section – "Gypsum Board Assemblies."
3. Division 9 Section – "Joint Sealants."
4. Division 22 Plumbing sections.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's product literature and installation instructions for each type tile and for manufactured mortars, grouts, crack isolation membrane, sealants and accessories. Include proportioning and mixing instructions for mortars, grouts, and latex additives.

B. Samples:
1. Tile: Submit minimum 12-inch by 12-inch (1-ft. by 1-ft.) size sample panels for each type tile in colors and textures selected. Prepare samples consisting of minimum four actual size tile units mounted on plywood or hardboard panels with grouted joints in width, color and material specified.
2. Trim and Accessories: Submit actual size sample of each type trim and accessory required.
3. Edge Protection and Transition Accessories: Submit minimum 6-inch length sample of actual accessory to be used.
4. Sealant: Submit actual sealant material sample in selected color(s) for Architect's approval.

C. Master Grade Certificates: Submit certificates for each shipment and type tile indicating that materials conform with ANSI A137.1.
1. Certificates shall indicate grade and types of tile, manufacturer's name, package identification numbers, date of shipment, name and location of project.

2. Tile manufacturer shall sign and issue certificates at time of shipping.

D. Setting and Grouting Material Approval: Submit letter from mortar, grout and latex additive manufacturer approving products proposed for use in accordance with setting and grouting material requirements specified herein.

E. Maintenance Data: Submit manufacturer's maintenance instruction for care and cleaning of each type tile. Indicate recommended cleaning products, methods and maintenance procedures. Include as part of Contract Closeout documents

1.4 QUALITY ASSURANCE:

A. Installer Qualifications: Installer shall have minimum Five (5) years' experience in satisfactory completion of tile installations of similar nature and scope as required for this project. If requested by Architect, submit evidence of satisfactory installations of similar work completed within the past three years; provide project list with references indicating architect and owner contact information.

B. Setting and Grouting Material Requirements: Setting mortars, grouts and latex additives shall be products of a single manufacturer. Products shall be as recommended and approved in writing by manufacturer, meeting specified requirements, for installation and substrate conditions indicated.

C. Allowable Tolerances: Finished work shall be plumb, level and true to line within ±1/4-inch in an undivided space and ±1/16-inch maximum in a running foot, non-cumulative.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials in manufacturer's original containers with labels intact and legible, identifying brand name and contents.
1. Tile cartons shall be sealed with labeled grade marking by manufacturer complying with ANSI A137.1, with grade seals unbroken.
2. Manufactured mortars, and grouts shall bear hallmarks certifying compliance with specified standards.

B. Store tile in original cartons with grade seals unbroken. Protect stored materials from damage or contamination from weathering, freezing, foreign matter, and other detrimental conditions.

C. Handle tile materials to prevent from cracking, chipping, breaking and other damages. Damaged tile shall not be permitted for installation and removed from site. Replace damaged materials at no additional cost to Owner.

1.6 PROJECT CONDITION:

A. Environmental Requirements:
1. Maintain temperatures above 50-degrees F. but not exceeding 100 -degrees F. in areas to receive tile during installation and minimum seven (7) days after completion unless otherwise directed by manufacturer's instruction.
2. If field mixed mortars and grouts are used, prepare mixtures when ambient temperatures are above 50-degrees F.

3. Comply with manufacturers recommended temperature conditions for factory-mixed mortars and grouts. Do not mix or use when temperature conditions are below minimum requirements.
4. Substrate temperatures shall be minimum 50-degrees F. and rising at time of installation unless otherwise directed by manufacturer's instructions. Do not apply setting materials to surfaces that contain frost.

B. Protection:
1. Provide barricades or protective methods to prevent traffic on tiled floor areas during installation and afterwards until materials are set firm.
2. Prohibit traffic on tiled floors for minimum seven days after grouting is completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Tile Manufacturers; subject to compliance with specified requirements:
1. American Olean Tile Company.
2. Concept Surfaces, LLC.
3. Crossville Inc.
4. Dal-Tile Corporation.
5. Florim USA / Florim Ceramiche S.P.A.

2.2 CERAMIC TILE:

A. Basis of Design: Tile products are as schedule on drawings and shall serve as the basis of design.
1. Tile products of similar design, construction, material composition, size, color, finish and quality by other acceptable manufacturers may be submitted for Architect's acceptance.
2. Acceptance is subject to compliance with specified requirements as evidenced by submittal of manufacturer's product data, material certificates, test reports and samples.

B. Porcelain Tiles:
1. Type: Impervious, porcelain paver meeting ANSI A137.1.
2. Nominal Face Size: As selected by Architect from manufacturer's standard, unless otherwise indicated on drawings.
3. Thickness: 9 mm (3/8-inch), nominal.
4. Edges: Cushion or Square.
5. Color: As indicated on Drawings.
6. Base and Trim Shapes: Provide 6-inch high coved base, including bullnose and corner units as required; matching porcelain tile in color, size and thickness.

C. Glazed Wall Tile:
1. Type: Non-vitreous tile meeting ANSI A137.1; semi-gloss or matte glazed.

2. Nominal Face Size: As selected by Architect from manufacturer's standard, unless otherwise indicated on drawings.
3. Thickness: 1/4-inch nominal.
4. Edges: Cushion.
5. Color: As indicated on Drawings.
6. Base and Trim Shapes: Matching wall tile in color and size for thin-set installation method. Include coved base units, bullnose caps, beads and corner units, as required.

2.3 SETTING MATERIALS:

A. Latex-Portland Cement Mortar:
1. Acceptable Products; subject to compliance with specified requirements:
a. Custom Building Products; MegaLite Crack Prevention Mortar.
b. Laticrete International, Inc.; 254 Platinum.
c. Mapei Corporation, Ultraflex 3.
2. Type: Prepackaged premium high bond strength, polymer modified dry-mortar mix meeting ANSI A118.15, composed of portland cement, graded aggregates and dry, redispersible, vinyl acetate or acrylic additives formulated for job-mixing with only water. Mortar shall be non-sag formulation designed for floor and wall installations and acceptable for applications in exterior and interior environments.

2.4 GROUT MATERIALS:

A. Polymer Modified Cement Grout:
1. Acceptable Products; subject to compliance with specified requirements:
a. Custom Building Products; Prism Ultimate Performance Grout.
b. Laticrete International, Inc.; Permacolor Grout.
c. Mapei Corporation; Ultracolor Plus Grout.
2. Type: Factory-prepared, polymer modified, sanded grout meeting ANSI A118.7; composed of portland cement or aluminate cement, graded aggregates, color-fast mineral oxide pigments, additives and dry, redispersible, latex/polymer powder formulated for job-mixing with only water.
3. Color: As selected by Architect from manufacturer's standard colors.

2.5 CONTROL AND EXPANSION JOINT MATERIALS:

A. Sealant:
1. Acceptable Products; subject to compliance with specified requirements:
a. BASF Corporation; MasterSeal NP 2.
b. Pecora Corp., Dynatrol II.
c. Tremco, Inc.; Dymeric 240 or 240FC.
2. Characteristics: Two-part, polyurethane-based sealant with separate pre-packaged pigmented concentrate color additive; meeting ASTM C920, Type M, Grade NS, Class 25; colors matching grout as selected by Architect.

B. Accessories:

1. Primer: Type recommended by sealant manufacturer.
2. Backup material: Flexible, non-compressive foam type as recommended by sealant manufacturer.
3. Divider strips: Type acceptable to sealant manufacturer.

2.6 EDGE PROTECTION AND TRANSITIONS ACCESSORIES:

A. Acceptable Manufacturer: Schluter Systems, L.P.

B. Types: Satin natural anodized extruded aluminum or stainless steel of style and dimensions to suit application, designed for setting with tile mortar or adhesive.

C. Locations: Provide trim accessories as indicated on Drawings, or as recommended by manufacturer, for the following locations and conditions required for the Project.

1. Open edges of floor tile.
2. Transition between floor finishes of different heights.
3. Thresholds at door openings.
4. Expansion and control joints, floor and wall.
5. At corner seam where tile is applied to a vertical surface.

2.7 CLEANING MATERIALS:

A. Tile and Grout Cleaners: Non-corrosive, non-acid based, neutral type as recommended and acceptable to tile and grout manufacturers; compatible with installed materials.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine substrate conditions to verify that surfaces to receive tile is sound, firm, dry, clean and free of oily or waxy films and curing compounds.

B. Verify that grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile have been installed prior to proceeding with tile work.

C. Notify Architect of any conditions detrimental to proper installation of materials. Make corrections to defective or unsatisfactory conditions as required.

D. Do not proceed with installation until defective or unsatisfactory conditions have been corrected and is acceptable to installer and Architect.

3.2 TILE INSTALLATION:

A. Install tile complying with TCNA installation methods indicated and applicable installation standards of ANSI A108, except where more stringent requirements are specified.

B. Locate accessories, control joints and expansion joints before installing tile. Coordinate location and alignment with tile joints.

C. Layout: Center tiles within areas to avoid unequal tile widths at opposite walls and tiles of less that 1/2 tile width.

1. Align tile joints straight, perpendicular and parallel to walls unless otherwise indicated.
2. Align joints in floor tile with joints in base or wall tile.
3. Terminate tile fitted neat at obstructions, edges and corners without disrupting pattern or joint alignment.

D. Cutting and Fitting: Cut and drill tiles without damaging or marring exposed tile faces. Rub cut edges smooth with carborundum stone.
1. Grind and fit tile at intersections, against trim and at built-in fixtures and accessories.
2. Fit tile around outlets, pipes, fixtures and fittings so that tile edges will be concealed under applied escutcheons, collars or plates.

E. Grout Joints: Maintain uniform joint widths, straight and aligned throughout installation. Install with joint widths for tile types specified.

F. Grout Joints: Provide 1/4-inch joint width, unless otherwise indicated. Maintain uniform joint widths, straight and aligned throughout installation.
1. Floor or Paver Tiles (tiles sizes larger than 8-inches): Provide 3/16-inch joint width, unless otherwise indicated.
2. Glazed Wall Tiles: Provide 1/8-inch joint width, unless otherwise indicated.

3.3 CONTROL AND EXPANSION JOINTS:

A. Locate control and expansion joints in accordance with TCNA EJ171. Location of joints shall be approved in advance by Architect.

B. Construct control and expansion joints extending through tile and setting bed. Leave joint cavities open, free of dirt, debris, grout, mortar and setting materials for installation of compressible materials and sealant. Do not saw cut joints after installation of tiles.
1. Locate floor control joints at spacings indicated but not to exceed 12-ft on center each direction.
2. Provide control joints at perimeter of floor tile areas abutting walls, curbs, columns, dissimilar floor materials and changes of substrates.
3. At vertical internal corners of wall tiles and where tiles abut dissimilar materials provide sealant control joints in lieu of grout joints.
4. Where tile work occurs over control joints or cold joints in structure, provide tile expansion joint located direct over structural joints.
a. Install crack isolation membrane to bridge joint to offset location of expansion joints in tile if required.
b. Width of tile expansion joint shall be same as structural joint width.

C. Width of tile control and expansion joints shall match width of grout joints, but not less than 1/4-inch, except for structural joints required to extend through tile shall be of matching width or greater.

D. Seal joints in accordance with TCNA EJ171. Prime joints and install sealant materials and related accessories in accordance with manufacturer's product data. Tool sealant joint concave.

3.4 EDGE PROTECTION AND TRANSITIONS ACCESSORIES INSTALLATION:

A. Prepare surfaces using methods recommended by the accessories manufacturer for substrates to which products are to be mounted.

B. Install in accessories to align flush with tile surfaces, unless product design indicates otherwise, according to manufacturer's printed instructions.

3.5 TILE INSTALLATION METHODS:

A. Floor Tiles; Thin-Set Over Concrete Slab-On-Grade, Interior:
1. Installation Method: TCNA F113-18 and F125-Partial-18 where offset location of control joints are required.
2. Setting Method: Latex-portland cement mortar. Install crack isolation membrane bonded to substrate as specified where required for offsetting control locations in tile.
3. Grout Type: Polymer modified cement grout.

B. Wall Tiles; Thin-Set Over Glass-Mat, Water-Resistant, Gypsum Backing Board, Interior:
1. Installation Method: TCNA W245-18.
2. Setting Method: Latex-portland cement mortar.
3. Grout Type: Polymer modified cement grout.

C. Tile Base; Thin-Set Over Gypsum Board, Interior:
1. Installation Method: TCNA W243-18.
2. Setting Method: Latex-portland cement mortar.
3. Grout Type: Polymer modified cement grout.

3.6 CLEANING AND PROTECTION:

A. Keep tile surfaces clean as work progresses. Do not permit setting and grouting materials, residue and other foreign materials to accumulate on tile face. Clean tile upon completion of installation as specified.

B. Clean installed tile in accordance with tile and grout manufacturer's recommendations using specified cleaners after setting materials have cured.
1. Allow grout installation to cure for minimum fourteen (14) days prior to permitting tile work to be cleaned.
2. Do not use acid solutions to clean tile.

C. Protection:
1. Upon completion of tile installation and after cleaning of tile and grout joints, protect tile work throughout remainder of construction by covering with heavy duty kraft paper or hardboard.
2. Prior to Date of Substantial Completion, remove protective covering for final cleaning.

END OF SECTION 093000

SECTION 095113

ACOUSTICAL PANEL CEILINGS

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: Acoustical panels and exposed suspension systems for ceilings.

B. Extent of each type acoustical ceiling is shown and scheduled on drawings.

C. Related work specified elsewhere includes:

1. Division 7 Section – "Joint Sealants."
2. Division 9 Section – "Gypsum Board Assemblies."

1.3 PERFORMANCE REQUIREMENTS:

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

C. Surface-Burning Characteristics: Complying with ASTM E 1264 for Class A materials and tested per ASTM E 84; testing performed by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less,
2. Smoke-Developed Index: 50 or less.

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

1.4 SUBMITTALS:

A. Product Data: Manufacturer's product specifications and installation instructions for each acoustical ceiling 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 seismic installation details.
2. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods, which may be detrimental to finishes and acoustical performance.

B. Shop Drawings: Show layout of ceiling including locations of light fixtures, grilles, diffusers and sprinkler heads.

1. Indicate hanger spacings, clip anchors or inserts, fastening details, splicing methods for main and cross runners.
2. Include details for ceiling level changes, support methods for light fixture, diffusers, grilles and similar items.

C. Samples:

1. Set of 6-inch by 4-inch square samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.
2. Set of 12-inch length samples of each exposed runner and molding.

D. Qualification Data: Submit for qualified installer to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling. (Submit for Architect's information only.)

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Firm with not less than three (3) years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install a minimum 12-ft by 12-ft. area of each ceiling type specified, in spaces designated by Architect.
2. Notify Architect when spaces are ready for observation and review. Obtain Architect's approval of mockups before starting installation.
3. Approved mock-up shall serve as a standard of quality for ceiling installations. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS:

A. Space Enclosure: Do not install interior acoustical ceiling until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

B. Coordination:

1. Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through, ceilings, including light fixtures, HVAC equipment, food service exhaust hoods, fire-suppression system components (if any), conveyor systems and partition system (if any).
2. Schedule installation to occur after other work which can generate dust is completed. Schedule acoustical material installation to minimize need for removal and replacement to accommodate work of other trades.

1.8 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. Deliver maintenance materials to Owner.

1. Acoustical Ceiling Units: Furnish quantity of full size units equal to two percent (2.0%) of amount installed.
2. Exposed Suspension Components: Furnish quantity of each exposed component required for actual installation equal to two percent (2.0%) of amount installed.

PART 2 - PRODUCTS

1.9 ACOUSTICAL CEILING PANELS:

A. Basis of Design: Product as scheduled on drawings.

1. Acoustical ceiling panels of similar design, material, construction and of matching color, pattern and texture by other acceptable manufacturers may be submitted for Architect's acceptance.
2. Acceptance is subject to compliance with specified requirements as evidenced by submittal of manufacturer's product data, test reports and samples.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

C. Panel Type: ASTM E 1264, Type IV, Form 2, Pattern E; water-felted mineral fiber, membrane-faced overlay panels with painted finish.

1. Size: 24 by 24 inches (2-ft. by 2-ft.), unless otherwise indicated on Drawings.
2. Thickness: 7/8-inch.
3. Edges: Rabbeted and beveled (Beveled Tegular).
4. Noise Reduction Coefficient (NRC): 0.80, minimum.
5. Ceiling Attenuation Class (CAC): 35, minimum.
6. Light Reflectance: 0.86.
7. Surface Finish: Factory-applied latex paint finish, white color.

D. Suspension System: Grid profile size as indicated on Drawings for scheduled ceiling panel. Provide grid module matching ceiling panel size.

1.10 METAL SUSPENSION SYSTEMS:

A. Acceptable Manufacturers; subject to compliance with specified requirements:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. USG Interiors, Inc.

B. Narrow Profile Exposed Grid System: Narrow-face, capped, double-web**,** galvanized steel suspension system.

1. Structural Classification: Intermediate duty system in accord with ASTM C635.
2. Main and Cross Runners: Roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished metal caps on flanges.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Galvanized cold-rolled steel.
6. Cap Face Size: 9/16-inch width.
7. Cap Finish: Factory-applied low-gloss paint finish; white color.

C. Standard Exposed Grid System: Wide-face, capped, double-web**,** galvanized steel suspension system.

1. Structural Classification: Intermediate duty system in accord with ASTM C635.

2. Main and Cross Runners: Roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished metal caps on flanges.
3. End Condition of Cross Runners: Override (stepped) type.
4. Face Design: Flat, flush.
5. Cap Material: Galvanized cold-rolled steel.
6. Cap Face Size: 15/16-inch width.
7. Cap Finish: Factory-applied low-gloss paint finish; white color.

D. Finishes and Colors: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1.11 SUSPENSION SYSTEM ACCESSORIES:

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   a. Type: Cast-in-place or Postinstalled expansion anchors.
   b. Corrosion Protection: Either type as specified.
      1) Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
      2) Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12-gauge (0.106-inch) diameter wire.

C. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint; sized to support design loads.

D. Angle Hangers: Angles with legs not less than 7/8-inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

E. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24-inches on center on all cross tees.

F. Edge Moldings and Trim: Roll-formed, sheet-metal type in profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

1.12 MISCELLANEOUS MATERIALS:

A. Fasteners: Cadmium plated, type recommended by suspension system manufacturer, but for not less than 1/2-inch penetration of substrate.

B. Acoustical Sealants:

1. Acceptable Products: Subject to compliance with requirements, provide one of the following:
   a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
   b. Pecora Corporation; AIS-919.
   c. Specified Technologies, Inc.; SpecSeal Smoke N' Sound Acoustical Caulk.
   d. Tremco, Inc.; Acoustical Sealant.
   e. USG Corporation; Sheetrock Acoustical Sealant.
2. Characteristics: Manufacturer's non-hardening, non-bleeding, nonstaining, gunnable, synthetic rubber or acrylic latex compound complying with ASTM C834.
   a. Acoustical Performance: Effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   b. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

1.13 EXAMINATION:

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1.14 PREPARATION:

A. Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings. Furnish concrete inserts, hanger clips and similar devices to other trades for installation well in advance of time needed for coordination of other work.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

C. Where suspended acoustical ceilings are indicated to be hung below drywall sub-ceilings, install sub-ceiling hanger clips at locations for hanger wire attachment. Attach clips screw fastened through gypsum board into support framing spaced at grid locations required for securing suspension system hangers wires.

1.15 INSTALLATION:

A. Install acoustical panel ceilings to comply with ASTM C 636 and design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to

inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48-inches on center along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8-inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16-inches on center and not more than 3-inches from ends, leveling with ceiling suspension system to a tolerance of 1/8-inch in 12-feet. Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange acoustical units and orient directionally patterned units, (if any) in a manner shown by reflected ceiling plans.
2. Install panels with pattern running in one direction, as indicated, or if not indicated, as directed by Architect.
3. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

4. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and in spaces as recommended by panel manufacturer's written instructions, unless otherwise indicated.

1.16 CLEANING:

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096500

RESILIENT FLOORING

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. Vinyl Composite Tile (LVT).
2. Resilient base.
3. Resilient stair accessories.
4. Resilient accessories.

B. Related Sections:
1. Division 3 Section – "Cast-In-Place Concrete."
2. Division 9 Section – "Gypsum Board Assemblies."

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's product specifications for each type resilient flooring material indicating compliance with specified requirements. Include installation and maintenance instructions. Indicate recommended installation adhesives, primers and cleaners.

B. Shop Drawings: Submit for each type of resilient flooring indicating rooms or spaces where they are to be installed.
1. Include floor tile layouts indicating edge conditions, columns, doorways, enclosing partitions, built-in furniture, cabinets and cutouts
2. Include transition details to adjacent flooring.
3. Show details of special patterns.

C. Samples:
1. Vinyl Composite Tile: Submit full size unit samples of flooring material in colors, textures, and patterns selected.
2. Resilient Base and Accessories: Submit 12-inch (1-ft.) length actual full-size sample of each type rubber base and accessory in color selected.

D. Qualification Data: Submit for qualified installer to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

E. Maintenance Data: Submit manufacturer's cleaning and maintenance instructions for each type of resilient flooring and accessory product installed on the Project. Include with closeout submittals.

1.4 QUALITY ASSURANCE:

A. Installer Qualifications: An entity having minimum three (3) years' experience that employs installers and supervisors who are competent in techniques required by manufacturer for resilient flooring installation of similar type, complexity and scope as required for this Project with a record of successful in-service performance.

B. Source Limitations: Provide each type of resilient flooring and installation materials as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

C. Regulatory Requirements: Flooring and accessories provided for installation in an accessible route and in accessible spaces shall comply with applicable provisions of the following regulations.

1. Code of Federal Regulations (CFR), Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
2. ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities.

D. Mockups: Build mockups to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Install minimum 50 sq. ft. area of resilient flooring for each type, color, and pattern in locations as directed by Architect.
2. Notify Architect when flooring mockups are ready for observation and review. Obtain Architect's approval of mockups before starting installation.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion, subject to compliance with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in manufacturer's original protective packaging or containers with labels intact and legible.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50-degrees F (10 degrees C) or more than 90-degrees F (32-degrees C). Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS:

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65-degrees F (18-degrees C) or more than 85-degrees F (29-degrees C), in spaces to receive floor tile for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65-degrees F (18-degrees C) nor more than 85-degrees F (29-degrees C).

C. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry as determined by resilient flooring manufacturer's recommended alkalinity and moisture tests.

1. Close spaces to traffic during floor tile installation.
2. Close spaces to traffic for 48 hours after floor tile installation.

1.7 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. Deliver stock of maintenance materials to Owner and store in locations as directed.

1. Resilient Flooring: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
2. Resilient Base: Furnish not less than 10-linear feet for every 500-linear feet or fraction thereof, of each type, color and size of resilient product installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITE TILE:

A. Acceptable Manufacturers; subject to compliance with specified requirements:

1. Armstrong Flooring, Inc.
2. Mannington Commercial / Mannington Mills, Inc.
3. Mohawk Group.
4. Shaw Contract / Shaw Industries Group, Inc.
5. Tarkett USA, Inc.

B. Basis of Design: Products as scheduled on drawings.

1. Vinyl Composite Tile of similar design, material, construction and of matching color, pattern and finish by other acceptable manufacturers may be submitted for Architect's acceptance.
2. Acceptance is subject to compliance with specified requirements as evidenced by submittal of manufacturer's product data and samples.

C. Flooring Material: Meeting ASTM F1700, Class III (Printed Film Vinyl Tile), Type B (Embossed Surface).
   1. Overall Thickness: 0.2-inch, nominal.
   2. Wearlayer Thickness: 20-mil (0.020-inch).
   3. Fire Performance:
      a. Critical Radiant Flux Classification: Meeting Class I, not less than 0.45 W/sq. cm., as determined by testing according to ASTM E 648 or NFPA 253.
      b. Smoke Density: Less than 450 specific optical density when tested per ASTM E 662 or NFPA 258.
   4. Finish: Manufacturer's enhanced urethane.
   5. Tile Size: As indicated on Drawings.
   6. Colors and Patterns: As indicated on Drawings.

2.2 RESILIENT BASE:

A. Acceptable Manufacturers; subject to compliance with specified requirements:
   1. Armstrong Flooring, Inc.
   2. Flexco Corporation.
   3. Johnsonite / Tarkett Company.
   4. Mannington Commercial / Mannington Mills, Inc.
   5. Roppe Corporation, USA.

B. Basis of Design: Products as scheduled on drawings.
   1. Resilient base of similar design, material, construction and of matching color by other acceptable manufacturers may be submitted for Architect's acceptance.
   2. Acceptance is subject to compliance with specified requirements as evidenced by submittal of manufacturer's product data and samples.

C. Type: Resilient rubber wall base complying with ASTM F 1861.
   1. Material: Type TS (rubber, vulcanized thermoset), Group 1 (solid homogeneous).
   2. Styles:
      a. Style A – Straight (toeless): Provide for installation at locations as scheduled on Drawings.
      b. Style B – Cove (top-set toe): Provide for installation at locations as scheduled on Drawings.
   3. Fire Performance:
      a. Critical Radiant Flux Classification: Meeting Class I, not less than 0.45 W/sq. cm., as determined by testing according to ASTM E 648 or NFPA 253.
      b. Smoke Density: Less than 450 specific optical density when tested per ASTM E 662 or NFPA 258.
   4. Thickness: 0.125-inch, minimum.
   5. Height: 4-inches, unless otherwise indicated on Drawings.

6. Lengths: Coils in manufacturer's standard lengths; not less than 100-ft. continuous rolls.
7. Finish: Matte.
8. Colors and Patterns: As selected by Architect from manufacturer's full range colors, unless otherwise indicated on Drawings.

D. Corner Fabrication: Job formed inside and outside corners.

2.3 RESILIENT ACCESSORIES:

A. Acceptable Manufacturers; subject to compliance with specified requirements:
1. Armstrong Flooring, Inc.
2. Flexco Corporation.
3. Johnsonite / Tarkett Company.
4. Roppe Corporation, USA.

B. Reducers and Transitions:
1. Material: Rubber or Vinyl.
2. Fire Performance:
a. Critical Radiant Flux Classification: Meeting Class I, not less than 0.45 W/sq. cm., as determined by testing according to ASTM E 648 or NFPA 253.
b. Smoke Density: Less than 450 specific optical density when tested per ASTM E 662 or NFPA 258.
3. Thickness: Same as abutting floor materials.
4. Width: 1-1/2 inch, minimum.
5. Edges: Tapered.

2.4 INSTALLATION MATERIALS:

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Primer: Type and brand recommended by resilient product manufacturer as required for substrates encountered.

C. Adhesives: Water-resistant type recommended by resilient-product and adhesive manufacturer for resilient products and substrate conditions indicated. Provide for installation of resilient base and accessories.

D. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

E. Cleaners: Types recommended by resilient-product manufacturer for materials installed.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of floor substrates comply with tolerances and other requirements specified in other sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with installation of flooring materials.

C. Verify that wall substrates receiving resilient base installation are within required tolerances and are free of cracks, ridges, depressions and contaminants that would interfere with adhesion of materials.

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

E. Installation of resilient products to substrates indicates acceptance of surfaces and conditions.

3.2 PREPARATION:

A. Prepare substrates according to resilient product manufacturer's written instructions to ensure proper installation of materials.

B. Concrete Substrates: Prepare concrete floor slabs according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that contain soap, wax, oil, or silicone, using mechanical methods recommended by flooring manufacturer. Do not use solvents.
3. Alkalinity Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 7 or more than 10 pH.
4. Moisture Testing: Perform tests recommended by manufacturer and as specified. Conduct one test for each 1000 sq. ft. of floor area, but not less than three tests in each installation area and with testing evenly spaced. Proceed with installation only after substrates pass testing.
   a. Anhydrous Calcium Chloride Test: Perform tests complying with ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3-lbs. of water/1000 sq. ft. in 24 hours.
   b. Relative Humidity Test: Perform tests using in-situ probes complying with ASTM F 2170. Proceed with installation only after substrates have a maximum seventy-five (75%) percent relative humidity level measurement.
5. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install floor tiles until materials are the same temperature as space where they are to be installed. Move resilient flooring and installation materials into spaces where they will be installed at least 48-hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient flooring just prior to start of installation.

3.3 VINYL FLOOR TILE INSTALLATION:

A. Comply with manufacturer's written instructions for installing vinyl floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width.

1. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
2. Lay tiles square with room axis unless otherwise indicated or directed by Architect

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered.

1. Discard broken, cracked, chipped, or deformed tiles.
2. Lay tiles with grain running in one direction unless otherwise indicated or directed by Architect.

D. Scribe, cut, and fit floor tiles to butt neat and tight to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Install feature strips cut to shapes, sizes and profiles as indicated on drawings. Scribe and fit to locations with tight joints.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.

H. Install floor tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

I. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT BASE INSTALLATION:

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

B. Unroll base material to allow to flatten out, relaxing material for minimum 24-hours. Cut material to maximum lengths practicable to minimize number of joints in finished installation. Double-cut adjoining lengths.

C. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

D. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

E. Adhere resilient base tight to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

F. Position base so that bottom edge or toe follows flooring surfaces. Adhere in place applying pressure to bond secure to substrates.

G. Do not stretch resilient base during installation.

H. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

I. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6-inches in length.
   a. Form without producing discoloration (whitening) at bends.
   b. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 6-inches in length.
   a. Miter or cope corners to minimize open joints. Scribe and fit to provide tight fitting joints. Where cove style base is used, form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed.
   b. Shave back of base where necessary to produce a snug fit to substrate.

J. Scribe and fit base to abutting materials.

3.5 RESILIENT ACCESSORIES INSTALLATION:

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

B. Cut materials to accurate lengths, sizes, and shapes indicated; scribe as required at abutting materials for proper fit. If cut from rolled materials allow to flatten prior to installation.

C. Butt resilient accessories to adjacent materials and tightly adhere to substrates throughout length of each piece.

D. Resilient Reducer and Transition Strips: Install at all transitions between dissimilar flooring materials, including at edges of carpet or resilient floor covering that would otherwise be exposed.

1. Apply adhesives and bond to substrate.
2. At door openings, locate centered under doors in their closed position.
3. Fit edge to door frame jambs without visible gaps or cracks.
4. Fit edges to abutting floor materials for flush fit.

3.6 CLEANING AND PROTECTION:

A. Comply with manufacturer's written instructions for cleaning and protecting resilient flooring.

B. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect installed resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Use protection methods recommended in writing by manufacturer.
2. Cover resilient floor surfaces with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over installed resilient coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Just prior to date of Substantial, remove protective covering and clean resilient flooring, including wall bases, stair treads and risers, using methods and procedures recommended by manufacturer.

1. After completion of cleaning, examine surfaces for damaged or distorted material.
2. Replace resilient materials which do not lay flat, including those with raised humps and similar distortions, puckers, scuff marks, abrasions and other surface imperfections which cannot be cleaned.

END OF SECTION 096500

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 CARPET TILE <CPT-1>

A. Manufacturers:
1. Interface (Basis of Design)
2. Shaw Contract Group

B. Color: Refer to Drawings

C. Pattern: Refer to Drawings

D. Fiber Content: 100 percent nylon 6, 6.

E. Fiber Type: Antron Lumena DNA Nylon Type 6,6.

F. Pile Characteristic: Tufted Textured Loop pile.

G. Density: 7,216 oz./cu. yd.

H. Pile Thickness: 0.295 inches for finished carpet tile.

I. Stitches: 9.8 stitches per inch (mm)>.

J. Total Weight: 80 oz./sq. yd for finished carpet tile.

K. Primary Backing/Backcoating: Manufacturer's standard composite materials

L. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

M. Primary Backing/Backcoating: Afirma II Hardback-

N. Tile.Backing System: Afirma II Hardback-Tile.

O. Size: 18 by 36 inches.

P. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
3. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
4. Tuft Bind: Not less than 10 lbf according to ASTM D1335.
5. Delamination: Not less than 3.5 lbf/in. 4 lbf/in. according to ASTM D3936.
6. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
7. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
9. Colorfastness to Light: Not less than 4 after **40** AFU (AATCC fading units) according to AATCC 16, Option E.
10. Electrostatic Propensity: Less than 2 kV according to AATCC 134.

2.2 INSTALLATION ACCESSORIES

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

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099100

PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

1.2 SUMMARY:

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces, except where noted otherwise.

1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
2. Painting includes field painting exposed steel and iron work, and primed metal surfaces.

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Examples of prefinished items not to be painted include, in part, the following factory-finished components:
   a. Architectural woodwork.
   b. Plastic laminate casework.
   c. Flush wood doors.
   d. Acoustical materials.
   e. Toilet compartments and urinal screens.
   f. Elevator entrance doors and frames.
   g. Elevator equipment
   h. Finished mechanical and electrical equipment.
   i. Light fixtures.
   j. Distribution cabinets.
   k. Finish Hardware.
2. Examples of concealed surfaces not to be painted include, in part, wall or ceiling surfaces in the following generally inaccessible areas:
   a. Foundation spaces.
   b. Furred areas.
   c. Ceiling plenums.

d. Utility tunnels.
e. Pipe spaces or chases.
f. Duct shafts.
g. Elevator shafts.

3. Examples of Finished metal surfaces not to be painted include, in part, the following:
   a. Anodized aluminum.
   b. Fluoropolymer finished aluminum or steel.
   c. Stainless steel.
   d. Chromium plate.
   e. Copper.
   f. Bronze.
   g. Brass.
4. Examples of operating parts not to be painted include, in part, moving parts of operating equipment such as the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS:

A. Product Data: Manufacturer's most current technical information, label analysis, and application instructions for each material proposed for use.
   1. List each material and cross-reference to scheduled paint types, and including each specific coating, finish system, and application.
   2. Identify each material by the manufacturer's catalog number and general classification.

B. Samples:
   1. For Initial Selection: For each type of finish-coat material indicated, submit manufacturer's color chips for surfaces to be coated.
   2. For Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
      a. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
      b. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

c. Submit painted samples on the following substrates for Architect's review of color and texture only.
   1) Gypsum Board: 6-by-10-inch samples on gypsum board, of each type finish and representative color. Apply primer, other base coats and final coats.
   2) Concrete Unit Masonry: 4-by-8-inch samples of masonry, with mortar joint in the center, for each finish and color.
   3) Painted Wood: 8-inch square samples for each color and material on hardboard.
   4) Stained or Natural Wood: 4-by-8-inch samples of natural or stained finish on representative wood surfaces of species specified.
   5) Ferrous Metal: 3-inch square samples for each color and finish applied on flat metal.

1.4 QUALITY ASSURANCE:

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates.
   1. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   2. Notify the Architect of any problems anticipated using the materials specified, prior to proceeding with work.

C. Material Quality: Provide the manufacturer’s best quality grade paint material of the various coating types specified.
   1. Paint material containers not displaying manufacturer’s product identification will not be acceptable.
   2. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude approved equivalent products of other manufacturers.

D. Color Pigments: Pure, non-fading, applicable types to suite substrates and service indicated.

E. Lead content in pigments or other painting materials and components is not allowed.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to the job site in the manufacturer’s original, unopened packages and containers bearing manufacturer’s name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer’s name, stock number, and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.

6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45-deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.
2. Take necessary measures to ensure that workers, others present or passing through or inspecting work areas (painting or any other work), and the work areas themselves are protected from fire and health hazards resulting from handling, mixing, and application of materials.

1.6 JOB CONDITIONS:

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50-deg F and 90-deg F, unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45-deg F and 95-deg F, unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog, or mist, or when the relative humidity exceeds 85-percent, or at temperatures less than 5-degrees F above the dew point, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
1. Apply no materials in spaces where dust is being generated.
2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer, during application, drying and curing periods.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with specified requirements, provide products of one of the following:
1. Benjamin Moore and Company.
2. PPG Industries, Inc. (PPG Paints).
3. The Sherwin-Williams Company.

2.2 PAINT MATERIALS:

A. Standard of Quality:
1. Except as otherwise noted, products specified as a standard of quality are manufactured by PPG Paints. Products of other specified acceptable manufacturers listed, similar in type and quality, are acceptable for use, subject to approval of product list submitted for review.

2. Where products other than those of the manufacturer listed as the standard of quality are specified in Painting Schedule, such products have been selected to achieve specific results and substitutions will be allowed only in accordance with Conditions of the Contract.

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. Paint thinners and tints shall be products of same manufacturer as paints or approved by manufacturer for use with their products. Use thinners only within the recommended limits if required.
3. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Color Pigments: Pure, non-fading, applicable types to suite substrates and service indicated.

D. Hazardous Materials Prohibition: Lead content in pigments or other painting materials and components is not allowed.

E. Colors: As selected by Architect from manufacturer's full range, unless otherwise indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint.

1. Do not begin paint application until unsatisfactory conditions have been corrected.
2. Start of painting will be construed as the Applicator’s acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION:

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning.
2. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.

2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

   a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.

   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

3. Concrete Floor Surfaces to be Sealed or Painted:

   a. Surface shall be free of curing compounds and contaminants.

   b. Clean concrete surfaces with a 5-percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before applying coating materials.

   c. If required, abrasive blast clean concrete surfaces as recommended by paint manufacturer, removing laitance and foreign matter, to produce open face texture finish similar to 100 grit fine sandpaper. Repeat procedure if sandpaper texture finish is not achieved. Surface preparation shall be acceptable to paint manufacturer.

   d. Remove debris and vacuum surfaces clean before application of coating materials.

4. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

   a. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

   b. Prime, stain, or seal unfinished wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

   c. When transparent finish is required, backprime with spar varnish.

   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.

   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

5. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
   a. Treat bare, sandblasted, or pickled clean metal with a metal treatment wash coat before priming.
   b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
6. Galvanized Surfaces: Clean galvanized surfaces with non- petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

D. Tinting: Tint each primer and undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied.
1. Tint undercoats to match the color of the finish coat(s), but provide sufficient differences in shade of undercoats to distinguish each separate coat.
2. Finish coats as scheduled, shall be same color for each coat required.

3.3 APPLICATION:

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied
1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
2. Paint surface treatments and finishes are indicated on the Drawings and in Specifications.
3. Finish colors will be selected after Bidding, unless indicated otherwise.
4. Provide finish coats that are compatible with primers used.
5. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
6. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give

special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

7. The term “exposed surfaces” includes areas visible when permanent or built-in fixtures, connector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
8. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
9. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
10. Finish doors on tops, bottoms, and side edges same as faces.
11. Sand lightly between each succeeding enamel or varnish coat.

B. Fire-Rated and Smoke-Rated Walls: Where fire-rated and smoke-rated walls run above suspended ceilings, paint by stenciling "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS" on wall surfaces to provide permanent identification according to building code requirements.

1. Make height of characters 3-inches and stroke width not less than 3/8-inch.
2. Space stenciling at 20-ft. (20'-0") on center but not less than one stenciling on each wall.

C. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

D. Mechanical items to be painted include, but are not limited to, the following:

1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Tanks that do not have factory-applied final finishes.
4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
5. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
6. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

E. Electrical items to be painted include, but are not limited to, the following:

1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

F. Primers:

1. Omit primer on metal surfaces that have been shop-primed and touch-up painted, only after verifying full compatibility of shop primers with materials specified for

the next coat and finish coats.

2. Primer may be omitted at previously painted existing surfaces in good condition, except at interior concrete, plaster and drywall surfaces, after repairs to any existing damaged substrates and after spot priming of existing damaged paint finish, followed by cleaning and preparation recommended in writing by paint manufacturer.

G. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying.

2. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

H. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

I. Block Fillers: Apply block fillers to new or previously unpainted concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Prime Coats: Before application of finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

K. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

L. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster.

1. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

2. Provide satin finish for final coats.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING:

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION:

A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide “wet paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINT SCHEDULE:

A. The quantities of coats specified are minimums. Contractor is responsible for application of any additional coats necessary to achieve required coverage and color uniformity.

B. Ferrous Metal Surfaces: PPG Paints (Full-Gloss Acrylic Enamel)

Primer (one coat):	PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Metal Primer.
Finish (two coats):	PPG 90-374 Series Pitt-Tech Interior/Exterior High Gloss DTM Industrial Enamels.

C. Galvanized Steel Surfaces: PPG Paints (Full-Gloss Acrylic Enamel)

Primer (one coat):	PPG 90-712 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
Finish (two coats):	PPG 90-374 Series Pitt-Tech Interior/Exterior High Gloss DTM Industrial Enamels.

D. Aluminum Surfaces: PPG Paints (Full-Gloss Acrylic Enamel)

Primer (one coat):	PPG 90-712 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
Finish (two coats):	PPG 90-374 Series Pitt-Tech Interior/Exterior High Gloss DTM Industrial Enamels.

E. Concrete Surfaces: PPG Paints (Semi-Gloss Acrylic Enamel)

Primer (one coat):	PPG 4-603XI Perma Crete Interior/Exterior Acrylic Latex Alkali Resistant Primer.
Finish (two coats):	PPG 6-900XI Series SpeedHide Exterior 100% Acrylic Latex Semi-Gloss.

F. Fiber-Cement Panel Surfaces: PPG Paints (Satin Acrylic Enamel)

Primer (one coat):	PPG 4-603XI Perma Crete Interior/Exterior Acrylic Latex Alkali Resistant Primer.
Finish (two coats):	PPG 6-2045XI SpeedHide Exterior 100% Acrylic Latex Satin.

G. Molded Polyurethane Millwork: PPG Paints (Satin Acrylic Enamel)

Primer (one coat):	Manufacturer's factory applied primer.
Finish (two coats):	PPG 6-2045XI SpeedHide Exterior 100% Acrylic Latex Satin.

H. Wood Surfaces; Painted Finish: PPG Paints (Full-Gloss Acrylic Enamel)

Primer (one coat):	PPG 17-921XI Seal Grip Interior Exterior Universal Acrylic Primer
Finish (two coats):	PPG 6-8534 Series SpeedHide Interior/Exterior 100% Acrylic Gloss

I. Wood Surfaces; Solid Stain Finish: PPG Paints (Acrylic Stain)

Finish (two coats):	PPG FLD820 Flood Pro Series Solid Color 100% Acrylic Stain

3.7 INTERIOR PAINT SCHEDULE:

A. The quantities of coats specified are minimums. Contractor is responsible for application of any additional coats necessary to achieve required coverage and color uniformity.

B. Ferrous Metal Surfaces: PPG Paints (Semi-Gloss Acrylic Enamel)

Primer (one coat):	PPG 6-208 Speedhide Interior/Exterior Rust Inhibitive Metal Primer..
Finish (two coats):	PPG 6-4510XI Series SpeedHide Zero Interior Zero VOC Semi-Gloss Latex.

C. Galvanized Steel Surfaces: PPG Paints (Semi-Gloss Acrylic Enamel)

Primer (one coat):	PPG 90-712 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
Finish (two coats):	PPG 6-4510XI Series SpeedHide Zero Interior Zero VOC Semi-Gloss Latex.

D. Painted Structural Steel Surfaces: PPG Paints (Semi-Gloss Acrylic Enamel)

Primer (one coat):	Shop applied primer.
Finish (two coats):	PPG 6-4510XI Series SpeedHide Zero Interior Zero VOC Semi-Gloss Latex.

E. Gypsum Board Surfaces: PPG Paints (Flat Acrylic Paint)

Primer (one coat):	PPG 6-4900XI SpeedHide Zero Interior Zero VOC Latex Sealer.
Finish (two coats):	PPG 6-4110XI Series SpeedHide Zero Interior Zero VOC Latex Flat.

F. Gypsum Board Surfaces: : PPG Paints (Eggshell Latex Acrylic Enamel)

Primer (one coat):	PPG 6-4900XI SpeedHide Zero Interior Zero VOC Latex Sealer.
Finish (two coats):	PPG 6-4310XI Series SpeedHide Zero Interior Zero VOC Latex Eggshell.

G. Concrete Masonry Unit (CMU) Surfaces [Shower Areas]: PPG Paints (Gloss - Polyamide Epoxy)

Block Filler (one coat):	Amerlock 400BF Epoxy Masonry Block Filler.
Finish (two coats):	PPG HPC High Gloss Epoxy 95-501 Series. All block pores shall be completely filled.

H. Concrete Masonry Unit (CMU) Surfaces [Men's and Women's Toilet Rooms]: PPG Paints (Semi-Gloss Acrylic Epoxy)

Block Filler (one coat):	PPG 6-15XI Speedhide Interior/Exterior Hi Fill Latex Masonry Block Filler.
Finish (two coats):	PPG 16-551 Series Pitt-Glaze WB Water-Borne Acrylic Epoxy. All block pores shall be completely filled.

I. Concrete Masonry Unit (CMU) Surfaces (Excluding Toilet Rooms and Shower Areas): Sherwin-Williams (Semi-Gloss Acrylic Enamel).

Block Filler (one coat):	PPG 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler.
Finish (two coats):	PPG 16-551 Series Pitt-Glaze WB Water-Borne Acrylic Epoxy.

J. Wood Surfaces; Painted Finish: PPG Paints (Semi-Gloss Acrylic Enamel)

Primer (one coat):	PPG 17-921XI Seal Grip Interior Exterior Universal Acrylic Primer
Finish (two coats):	PPG 6-4510XI Series SpeedHide Zero Interior Zero VOC Semi-Gloss Latex.

K. Wood Surfaces; Solid Stain Finish: PPG Paints (Acrylic Stain)

Finish (two coats):	PPG FLD820 Flood Pro Series Solid Color 100% Acrylic Stain

L. Wood Surfaces; Semi-Transparent Stain Finish: PPG Paints (Acrylic/Oil Stain)

Finish (two coats):	PPG FLD812 Flood Pro Series Semi-Transparent Acrylic/Oil Stain

M. Concrete Floor Sealer: PPG Paints (Waterbased Semigloss, Polyamine Epoxy)

Substrate Preparation:	Blast cleaned prepared concrete surface.
Finish (two coats):	PPG 98-57 Series Aquapon WB Interior Floor Coating.

END OF SECTION 099100

SECTION 102113

TOILET COMPARTMENTS

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: Solid-plastic toilet compartments and urinal screens.

B. Related Sections:

1. Division 9 Section – "Gypsum Board Assemblies" for concealed steel strap backing plates for blocking and bracing within metal stud walls for anchorage of compartment and screen components.
2. Division 10 Section - "Toilet Accessories" for toilet tissue dispensers, grab bars, sanitary napkin disposal units, and similar accessories mounted to toilet compartments.

1.3 PERFORMANCE REQUIREMENTS:

A. Surface-Burning Characteristics: Meeting Class B, minimum, when tested according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's current detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories. Include construction details indicating materials, dimensions of individual components and profiles, and finishes for partition panels.

B. Shop Drawings: Submit for toilet compartments and urinal screens. Include plans, elevations, sections, details, and attachment details.
1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.
4. Show overhead support or bracing locations.
5. Indicate attachments to other work.

C. Samples:
1. For Initial Selection: Submit manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of unit indicated.

2. For Verification: Submit the following in manufacturer's standard sizes unless otherwise indicated:
   a. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch square samples of same thickness and material indicated for Work.
   b. Each type of hardware and accessory, if requested by Architect.

D. Maintenance Data: Submit manufacturer's maintenance instruction for care and cleaning of partition panel surfaces to include in maintenance manuals. Indicate recommended cleaning products, methods and maintenance procedures. Include as part of Project Closeout documents.

1.5 QUALITY ASSURANCE:

A. Source Limitations: Obtain toilet compartments and screens, including hardware and accessories, from a single manufacturer and from a single source.

B. Regulatory Requirements: Comply with applicable provisions of the following regulations and standards for toilet compartments and urinal screens designated as accessible.
1. Code of Federal Regulations (CFR), Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
2. ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities.

1.6 PROJECT CONDITIONS:

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments and urinal screens by field measurements before fabrication. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with specified requirements provide products of one of the following:
1. Bradley Corporation.
2. Columbia Partitions / Div. Partition Systems Incorporated of South Carolina.
3. General Partitions Mfg. Corp.
4. Hadrian, Inc.
5. Scranton Products, Inc.

2.2 MATERIALS:

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

G. Plastic Panels: Manufacturer's solid, high-density polyethylene (HDPE) resin compound molded under pressure into panels of homogeneous color and pattern throughout.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS AND SCREENS:

A. Basis of Design: Scranton Products, Inc.; products as specified below.
1. Hiny Hiders Partitions (standard flush panel design).

B. Compartment and Screen Styles:
1. Toilet-Enclosures: Overhead braced, floor anchored.
2. Urinal-Screens: Wall hung.

C. Door, Panel, Screen, and Pilaster Construction: Fabricated from specified solid polymer panel material.
1. Thickness: 1-inch, minimum.\
2. Panel Face and Edges: Seamless face with beveled or rounded eased edges.
3. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
4. Color and Pattern: As selected by Architect from manufacturer's full range selection; one color and pattern in each room will be selected.

D. Engraved Door Panels: Manufacturer's engraved design simulating raised panels. Design shall be as selected by Architect from manufacturer's standard options.

E. Pilaster Shoes: Manufacturer's standard design; polymer or stainless steel.
1. Polymer Material: Manufacturer's standard in color and pattern matching pilaster.
2. Stainless Steel: Type 304 alloy stainless steel sheet meeting ASTM A 666 or ASTM A 167.

F. Overhead-Bracing (Headrail): Manufacturer's standard continuous extruded aluminum headrail of anti-grip profile, with clear anodized finish.
1. Provide concealed anchorage where possible, with concealed anchorage blocks, and exposed ends neatly closed with either matching end cap and/or filler.
2. Return to side and back/rear walls at ends of runs, and again to back/rear walls at any locations where partition layouts off-set.

G. Brackets (Fittings): Manufacturer's heavy duty full-height continuous length; minimum 16 gauge (0.062-inch) thickness, type 304 stainless steel mounting brackets with pre-drilled holes for attachment of panels and pilasters; satin finish.

1. Provide channel, angle, and double-angle-channel types as required for application conditions.
2. Limit exposed angle flanges to interior of stalls where possible, and where permanence of installation will not be reduced or otherwise affected.

2.4 HARDWARE AND ACCESSORIES:

A. Continuous Hinges: Manufacturer's full length heavy duty, minimum 14 gauge (0.78-inch) type 304 stainless steel continuous hinge; self-closing multi-cam type; satin finish.
1. Hinges shall be designed for continuous anchorage of door panels to pilasters; pre-drilled to accept specified fasteners spaced at maximum 8-inches on center with first and last holes located not more than 2-inches from each end.
2. Hinge cam shall pre-set door positions with out-swings to normal closed position and in-swings to partial open position.

B. Latch, Strike and Keeper: Manufacturer's heavy duty stainless steel surface-mounted slide latch unit, minimum 14 gauge (0.78-inch) material thickness; satin finish.
1. Strikes shall be of design for emergency access with combination rubber-faced door strike and keeper.
2. Provide units that comply with ADA requirements at compartments designated as accessible.

C. Coat Hooks for Compartments:
1. Bumper and Coat Hook for In-Swinging Doors: Manufacturer's heavy duty stainless steel, minimum 14 gauge (0.78-inch) material thickness, combination bumper and hook; satin finish with rubber bumper; sized to prevent door from hitting compartment-mounted accessories.
2. Coat hook for out-swinging doors: Manufacturer's heavy duty stainless steel design; minimum 14 gauge (0.78-inch) material thickness, satin finish. Coat hook shall be mounted above finish floor at height complying with ADA requirements.

D. Door Pull for Out-Swinging Doors: Manufacturer's heavy duty stainless steel design for mounting on door direct on opposite side of latch and complying with ADA requirements; minimum 14 gauge (0.78-inch) material thickness; satin finish. Provide pulls on both sides of doors at compartments designated as accessible. Mount with through-bolts.

E. Wall Bumper for Out-Swinging Doors: Wall-mounted heavy duty stainless steel type with rubber bumper; satin finish.

F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads.
1. Provide sex-type bolts for through-bolt applications.
2. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 FABRICATION:

A. Fabricate toilet compartment and urinal screen components to sizes indicated.
1. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

2. Verify door clearances with fixtures and coordinate clearances with toilet accessories.

B. Overhead-Braced, Floor-Anchored Partitions: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
1. Make provisions for setting and securing continuous head rail at top of each pilaster.
2. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to floor.
3. Fabricate pilaster shoes to conceal anchorage and leveling mechanism.

C. Urinal-Screens: Fabricate panels for wall hung installation with specified continuous brackets.

D. Door Sizes and Swings: Unless otherwise indicated, provide toilet compartments with the following door sizes and swings as specified.
1. Standard Compartments: 24-inch width, in-swinging doors.
2. Accessible Compartments: 36-inch width, out-swinging doors; providing not less than 32-inch wide clear opening when installed.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

B. Confirm location and adequacy of blocking and supports required for installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Clearances for Panels, Doors and Pilasters :
a. Between Panel and Pilaster: 1/2-inch maximum, except where concealed fasteners are used.
b. Between Door Edge and Pilaster: 1/4 inch, maximum.
c. Between Panel and Wall: 3/4-inch maximum
2. Full-Height (Continuous) Bracket Installation: Secure panels to walls and to pilasters with full-height brackets.
a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

c. Attach brackets rigid in place with tamper-resistant fasteners.

B. Overhead-Braced, Floor-Anchored Units:
1. Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions.
2. Secure continuous head rail to each pilaster with not less than two fasteners.
3. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
4. Brackets: Secure panels to walls and to pilasters with continuous full length brackets as specified.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING AND CLEANING:

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

B. Cleaning: Clean exposed surfaces of toilet compartment and urinal screens, including hardware, by washing using neutral detergent and water. Rinse washed surfaces with clean water and wipe dry with soft, absorbent lint-free cloths.

C. Protection: Provide final protection and maintain conditions that ensure toilet compartments and urinal screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 102113

SECTION 102813

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. Section Includes: Toilet room accessories. The extent of toilet and other accessory items are indicated on the Drawings, and include the following:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Childcare accessories.
4. Underlavatory guards.
5. Custodial accessories.

B. Related Sections:

1. Division 4 Section – "Unit Masonry."
2. Division 9 Section – "Gypsum Board Assemblies."
3. Division 10 Section - "Toilet Compartments."

1.3 SUBMITTALS:

A. Product Data: Submit for each toilet accessory item specified, including details of construction relative to materials, dimensions, gauges, profiles, method of mounting, specified options, and finishes.

B. Product Schedule: Indicate types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using same designations indicated on Drawings.

C. Setting Drawings: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

D. Maintenance Data: Submit toilet accessories manufacturers to include in maintenance manuals. Submit as part of contract closeout documents.

1.4 QUALITY ASSURANCE:

A. Single-Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

B. Regulatory Requirements: Comply with applicable provisions of the following regulations and standards for toilet and shower accessories installed at locations designated as accessible.

1. Code of Federal Regulations (CFR), Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
2. ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities.

C. Product Certification: Electric hand dryers shall be ETL listed by Intertek Group, plc or UL listed by Underwriters Laboratories, Inc. in conformance with UL 507 standard.

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

1.5 COORDINATION:

A. Toilet Accessories: Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

B. Grab Bar Anchor Plates: Coordinate installation of concealed anchor plates with drywall and masonry wall construction for mounting of grab bars.

C. 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.

1.6 WARRANTIES:

A. Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within warranty period of not less than Fifteen (15) years from date of Substantial Completion.

B. Hand Dryer Warranty: Manufacturer's standard form covering defects in materials and workmanship under normal use. Manufacturer agrees to replace or repair defective parts within warranty period of not less than Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers; subject to compliance with specified requirements:

1. American Specialties, Inc. (ASI).
2. Bobrick Washroom Equipment, Inc.

3. Bradley Corporation.

2.2 BASIC MATERIALS AND FINISHES:

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22-gauge (.034-inch) minimum thickness, unless otherwise indicated.

B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16, Castings, ASTM B-30.

C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gauge (.040-inch) minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527, G60.

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

F. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

H. Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory units requiring internal access for servicing and resupply. Provide minimum of 6-keys to Owner's representative and obtain receipt.

2.3 PUBLIC-USE WASHROOM ACCESSORIES:

A. Toilet Tissue Dispenser (Standard Roll): TA01.

1. Basis-of-Design Product: Bobrick B-2840.
2. Description: Double-roll dispenser with utility shelf.
   a. Mounting: Surface mounted.
   b. Operation: Non-control delivery with theft-resistant spindle.
   c. Capacity: Up to 5 1/2-inch diameter tissue rolls.
   d. Material and Finish: Stainless steel, No. 4 satin finish, with high impact, black, polystyrene spindles.

B. Soap Dispenser, Foam Type, Manual: TA16.

1. Basis-of-Design Product: Sloan SJS-1100.
2. Description: Automatic Foam Soap Dispenser.
   a. Mounting: Wall mount, surface.
   b. Capacity: 34 fl. oz.
   c. Materials: Polished Chrome Plated Plastic.
   d. Refill Indicator: Window type.
   e. Accessories: Provide 2 refill bags for each unit.

C. Grab Bar (short): TA20..

1. Basis-of-Design Product: Bobrick B-6806 × 18.
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 18 inches long.

D. Grab Bar (medium): TA21.

1. Basis-of-Design Product: Bobrick B-6806 × 36.
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 36 inches long.

E. Grab Bar (long): TA22.

1. Basis-of-Design Product: Bobrick B-6806 × 42.
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish:
   a. Material: Stainless steel, 0.05 inch thick.
   b. Finish: Smooth, No. 4 satin finish on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: Straight, 42 inches long.

F. Mirror, Framed, without Shelf: TA23.

1. Basis-of-Design Product: Bobrick B-165-2436.
2. Frame: Stainless steel channel.
3. Corners: Mitered, welded, and ground smooth.
4. Hangers: Produce rigid, tamper and theft-resistant installation, using one-piece, galvanized steel, wall hanger device with spring action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
5. Size: 24 inches wide × 36 inches high.

G. Sanitary Napkin Disposal Unit, Surface-mount: TA29.

1. Basis-of-Design Product: Bobrick B-254.
2. Mounting: Surface mounted.

3. Door or Cover: Self-closing disposal opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4.

2.4 WARM AIR DRYERS:

A. Warm Air Dryer: TA50.

1. Basis-of-Design Product: Bobrick B-7128-115V.
2. Mounting: Surface mounted.
3. Operation: Electronic sensor activated with timed power cut-off switch.
4. Operation Time: 30 to 40 seconds.
5. Cover Material and Finish: Stainless steel, No. 4 satin finish.

2.5 CHILDCARE ACCESSORIES:

A. Diaper-Changing Station: TA55.

1. Basis-of-Design Product: Koala KB110-SSWM.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support a minimum of 250-lb static load when opened.
   b. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
   c. Operation: By pneumatic shock-absorbing mechanism.
   d. Material and Finish: Stainless steel, No. 4 satin finish.
   e. Liner Dispenser: Built in.

2.6 UNDERLAVATORY GUARDS:

A. Underlavatory Guard: TA58.

1. Basis-of-Design Product: Plumberex Soft Guard Plus.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.7 CUSTODIAL ACCESSORIES:

A. Mop and Broom Holder: TA60.

1. Basis-of-Design Product: Bobrick B-224 × 36.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Three.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.

6. Material and Finish: Stainless steel, No. 4 satin finish.
   a. Shelf: Not less than nominal 0.05 inch thick stainless steel.
   b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.8 FABRICATION:

A. Manufacturer's Identification: Only a maximum 1-1/2-inch diameter, unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on an inconspicuous face of toilet or bath accessory units. Identification mark shall be located on either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories: Fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six (6) keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install toilet accessory units according to manufacturers' current written instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit.

B. Use concealed fastening methods for attachment of accessories unless otherwise specified by product types employing exposed fastener installations.

C. Install units plumb and level, firmly anchored in locations and at heights indicated.

D. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

1. Anchor grab bar to metal stud partitions using manufacturer's minimum 12-gauge (0.109-inch) thickness by 3-inches width steel anchor plates tapped to receive machine screws. Anchor plates shall be of continuous length required to facilitate attachment of grab bars, spanning between studs.
   a. Attach anchor plates to studs at grab bar mounting heights, using self-tapping sheet metal screws or by welding.
   b. Where grab bar mounting flanges require attachment at different walls or at vertical or angled positions, provide anchor plates of lengths to span between studs at each flange location.

c. Secure grab bars to anchor plates using 1/4-inch diameter stainless steel machine screws.

2. Mount grab bars to masonry and concrete walls using 1/4-inch diameter stainless steel machine screws and expansions shields.

E. Make electrical connections to hand dryers complying with requirements specified in Division 26-Electrical sections.

3.2 ADJUSTING AND CLEANING:

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings and films prior to cleaning.

C. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 102813

SECTION 10 73 01

ALUMINUM WALL HUNG CANOPY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Design, fabrication, and installation of welded extruded aluminum canopy systems.

1.2 REFERENCES

IA. The Aluminum Association (AA):
1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):
1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):
1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM C 150, Specification for Portland Cement.
4. ASTM C 404, Specification for Aggregates for Masonry Grout.

E. American Welding Society (AWS):
1. ANSI/AWS D1.2, Structural Welding Code - Aluminum.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:
1. Design Walkways in accordance with The Aluminum Design Manual 2000.
2. Comply with the wind requirements of ASCE 7.
3. Provide an all welded extruded aluminum canopy system complete with internal drainage. Non-welded systems are not acceptable.
4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

1.4 SUBMITTALS

A. Product Data: Manufacturer's product information, specifications, and installation instructions for canopy components and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details.

C. Samples:
1. Selection: Manufacturer's standard range of colors for the finishes selected.
2. Verification: 2-inch-square samples of each finish selected on the substrate specified.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the canopy system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication, and erection of extruded aluminum canopy systems.

B. Installer Qualifications: Have canopy installed by manufacturer, third party installation is not acceptable.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Mapes (Basis of Design)
B. Peachtree Protective Covers, Inc.
C. Dittmer Architectural Aluminum.

2.2 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Gaskets: Dry seal santoprene pressure type.

E. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.0 FABRICATION

A. General:

1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
2. Welding: In accordance with ANSI/AWS D1.2.
3. Gutter Frame Construction: Factory assemble gutter fascia frames to form a one-piece welded frame. Make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Gutter frames constructed by mechanically fastening components together are not acceptable.
4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each.

B. Beams: Where applicable provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

C. Deck: Extruded self-flashing sections interlocking into a composite unit.

D. Fascia: Fascia shall be standard extruded 10" C-Channel style.

E. Hanger Assemblies: Provide extruded aluminum hanger rods in manufacturer's standard shapes and sized to meet the loads seen by canopy.

H. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.

5. High performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
   a. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   b.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.2 ERECTION

A. Erect canopy true to line, level, and plumb.
B. Provide hairline miters and fitted joints.

3.3 CLEANING

A. Clean all canopy components promptly after installation.

3.4 PROTECTION

A. Protect materials during and after installation.

END OF SECTION 107301

SECTION 122413

ROLLER WINDOW SHADES

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. Manually operated roller shades.
2. Motor-operated roller shades.

B. Related Sections:
1. Division 8 Section "Aluminum Entrances and Storefronts" for coordination with storefront framing to which roller shades are to be mounted.
2. Division 8 Section "Glazed Aluminum Curtain Wall System" for coordination with curtain wall framing to which roller shades are to be mounted.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data for roller shades indicating styles, material descriptions, construction details, dimensions of individual components and profiles, operating features, and finishes. Include installation and operating instructions.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
1. Include window head details indicating method of attachment.
2. Indicate location and clearances from window glazing.
3. Include details of installation and diagrams for power, signal, and control wiring for motor-operated shades.

C. Samples: Submit for each type of roller shade.
1. Roller Shade: Full-size operating unit, not less than 16-inches wide by 36 inches long for each type of roller shade indicated.
2. Shadeband Material: Not less than 3-inches square. Mark interior face of material if applicable.
3. Installation Accessories: Full-size unit, not less than 10-inches long.

D. Qualification Data: Submit for qualified installer to demonstrate their capabilities and experience; include documentation indicating compliance with specified qualification requirements. (Submit for Architect's information only.)

E. Product Certificates: Submit for each type of shadeband material, signed by product manufacturer. (Submit for Architect's information only.)

F. Product Test Reports: Submit reports indicating results of tests performed by manufacturer and witnessed by a qualified testing agency for each type of shadeband material.

G. Operation and Maintenance Data: Include manufacturer's operating instructions and recommended cleaning procedures for roller shades to include in maintenance manuals. Submit as part of contract closeout documents.

1.4 EXTRA MATERIALS:

A. Furnish extra materials that match products installed. Provide materials packaged with protective covering for storage and identified with labels describing contents.
   1. Quantity: Furnish full-size roller shade units equal to five-percent (5%) of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.
   2. Storage Instructions: Deliver stock of extra materials to Owner and store in locations as directed.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Installer shall be trained and certified by the roller window shade manufacturer with a minimum of five (5) years' experience in installing products comparable to those specified.

B. Source Limitations: Obtain roller shades from a single manufacturer and from a single source.

C. Mockups: Build mockups to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion, subject to compliance with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 PROJECT CONDITIONS:

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on shop drawings.

1. Allow clearances for operating hardware of operable glazed units through entire operating range.
2. Notify Architect of installation conditions that vary from Drawings.
3. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

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

1. Lutron Electronics Company, Inc.
2. MechoShade Systems, Inc.
3. Nysan Solar Control Inc. / Hunter Douglas Company.
4. Spring Window Fashion, LLC.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS:

A. Basis of Design: MechoShade Systems, LLC.; Mecho/5 Manual Shade System.

B. Design: Manual, single roller design; surface-mounted with fascia.

C. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's Stainless steel drive chain.
   a. Loop Length: Full length of roller shade.
   b. Limit Stops: Provide upper and lower ball stops.
   c. Chain-Retainer Type: Chain tensioner, sill mounted.
2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades. Provide for shadebands that weigh more than 10-lbs. or for shades as recommended by manufacturer, whichever criterion is more stringent.

D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's removable spline fitting into integral channel in tube.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

F. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Type: Enclosed in sealed pocket of shadeband material.
   b. Color and Finish: As selected by Architect from manufacturer's full range selection.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3-inches.
2. Endcap Covers: Provide to cover exposed endcaps.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range selection.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES:

A. Basis of Design: MechoShade Systems, LLC.; ElectroShade Motorized Shade System.

B. Design: Motorized, single roller design; surface-mounted with fascia.

C. Motorized Operating System: Manufacturer's factory-assembled, shade-operator system of size and capacity required, with features, characteristics, and accessories suitable for indicated conditions. Furnish system complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories. Include wiring from motor controls to motors.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular type, enclosed in roller.
   a. Electrical Characteristics: 110-VAC.
   b. Maximum Total Shade Width: As required to operate roller shades indicated.
   c. Maximum Shade Drop: As required to operate roller shades indicated.
   d. Maximum Weight Capacity: As required to operate roller shades indicated.
3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
   a. Individual/Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
   b. Infrared Control: System consisting of concealed receiver complete with external eye and connecting modular cable and two portable,

multiple-channel transmitters with separate buttons to open and close individual or groups of shades, to open and close shades simultaneously, and to stop shade movement.

c. Timer Control: Clock timer, seven-day programmable for regular events.

d. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.

4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.

D. Rollers, Shadebands, Mounting Hardware and Accessories: Same as specified for manually-operated roller shades.

2.4 SHADEBAND MATERIALS:

A. Shadeband Material Flame-Resistance Rating: Complying with NFPA 701 and tested by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Roller shade manufacturer's stain and fade resistant woven fabric.

1. Type: PVC-coated polyester.
2. Weave: Basketweave.
3. Weave Openness Factor: Five-percent (5%), approximate.
4. Fabric Thickness: 0.025-inch.
5. Orientation on Shadeband: Up the bolt.
6. Color: As selected by Architect from manufacturer's full range selection.

2.5 ROLLER SHADE FABRICATION:

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees F.:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4-inch per side or 1/2-inch total, plus or minus 1/8-inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4-inch, plus or minus 1/8-inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.

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

3.2 ROLLER SHADE INSTALLATION:

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions and final reviewed shop drawings.

B. Mount roller shade assembly located so shadeband is not closer than 2-inches clear from interior face of window glass. Allow clearances for window operation hardware.

C. Electrical Connections: Connect motor-operated roller shades to building electrical system.

D. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING, CLEANING AND PROTECTION:

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

B. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

D. Replace damaged roller shades that cannot be repaired, in a manner acceptable to Architect, before time of Substantial Completion.

3.4 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Division and the accompanying drawings cover furnishing of all materials, labor, equipment, and appliances, and in performance of all operations in connection with the installation of a complete air conditioning, ventilating, heating, plumbing and fire protection systems as specified herein and as shown.

1.2 CODES AND REGULATIONS

A. All materials and workmanship shall comply with the latest editions of the following codes and standards, as applicable:

2010 ADA Standards for Accessible Design

International Building Code, 2018 Edition, with Georgia Amendments

National Electrical Code, 2017 Edition, with no Georgia Amendments

International Energy Conservation Code, 2015 Edition, with Georgia Supplements and Amendments

International Fire Code, 2018 Edition, with no Amendments

International Fuel Gas Code, 2018 Edition, with Georgia Amendments

International Mechanical Code, 2018 Edition, with Georgia Amendments

International Plumbing Code, 2018 Edition, with Georgia Amendments

ASHRAE STANDARD 90.1-2008, ENERGY EFFICIENT DESIGN FOR NEW BUILDINGS

ASHRAE STANDARD 62-2006, VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY WITH AMENDMENTS.

MANUFACTURER'S STANDARDIZATION SOCIETY (MSS) STANDARD PRACTICE (SP) 58: PIPE HANGERS AND SUPPORTS - MATERIALS, DESIGN, AND MANUFACTURE

MSS SP-69: PIPE HANGERS AND SUPPORTS - SELECTION AND APPLICATION

MSS SP-69: PIPE HANGERS AND SUPPORTS - FABRICATION AND INSTALLATION PRACTICES

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) PAMPHLET 13: INSTALLATION OF AUTOMATIC SPRINKLER SYSTEMS

NFPA 90A: INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS, 2002 Edition

NFPA 90B: INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS, 2002 Edition

NFPA 101: SAFETY TO LIFE FROM FIRE IN BUILDINGS AND STRUCTURES, 2000 Edition

ALL PREVAILING LOCAL, STATE, CITY AND COUNTY CODES

B. All workmanship and materials shall comply with all ordinances and regulations of all local authorities having jurisdiction.

C. Contractor shall obtain all permits and licenses as required for execution of the contract. PERMIT FEES SHALL BE PAID BY THE CONTRACTOR. ANY UTILITY METER FEES, TAP FEES, OR IMPACT FEES SHALL BE PAID BY THE OWNER. Arrange for necessary inspections required by City, County, State, and other authorities having jurisdiction, and deliver certificates of approval to the Owner.

D. No mechanical, plumbing or fire protection equipment, ductwork or piping shall be located within 42" of electrical switchboards or panelboards.

E. No water piping (HVAC, domestic, storm, sanitary, or sprinkler) shall be located above electrical switchboards or panelboards. If the governing authority requires fire sprinklers in the electrical rooms, spray shields shall be fabricated and installed to protect the live panels or switchboards from spray from sprinkler discharge.

1.3 DRAWINGS AND SPECIFICATIONS

A. Should any items be omitted from the Drawings and be herein specified, or vice versa, it shall be executed the same as if shown and combined in both. Should contradictions be found, definite provisions of the Specifications will be preferred to varying requirements of the Drawings, excepting that should the Drawings in note or otherwise be the more complete and show work and material more suitable for the locations, and such as to form the more reasonable basis for estimating, then upon the decision of the Engineer, to such effect, such Drawings shall have preference in authority.

B. For purposes of clarity and legibility, Drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, make use of all data in all of Contract Documents and verify this information at building site.

C. Drawings indicate required size and points of termination of pipes and conduits and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of the Contractor to make installation in such a manner as to conform to structure, avoid obstructions, preserve head room, and keep openings and passageways clear.

D. Install piping, ductwork, and equipment as close as possible to locations shown. Notify Architect when any conflicts arise during erection of piping. MAKE NO IMPROVISIONS OR FIELD CHANGES WITHOUT ARCHITECT'S PRIOR WRITTEN APPROVAL.

E. Furnish layout drawings to Architect indicating all changes to meet space requirements, code requirements and as necessary to resolve all space conflicts.

F. Large scale details will be furnished by the Architect for all work which, in the opinion of the Engineer, requires such drawings. DETAILS SHALL BE ACCURATELY FOLLOWED, DEVIATION THEREFROM BEING CAUSE FOR REJECTION OF THE WORK AS EXECUTED. Shop Drawings will not be furnished by the Engineer.

G. Explanatory note shall be preferred to conflicting drawn out indication. Large scale details shall be preferred to scale measurements. In all cases the details and scale drawings shall be checked with existing conditions. Should any variation be found, it shall be immediately referred to the Architect for clarification and adjustment.

H. No partial sets of Drawings and Specifications will be issued by the Owner.

1.4 BUILDING LAWS, PERMITS AND ORDINANCES

A. The Contractor shall comply with all local ordinances, all Federal and State Laws, and all rules and regulations of health, public or other authorities controlling or limiting the method, the material to be used, or the action of those employed in the work of this character. The Contractor shall procure at his own expense, all building permits for the construction of this project.

1.5 EXAMINATION OF SITE - DRAWINGS AND SPECIFICATIONS

A. Examine site carefully to determine conditions to be encountered, work to be performed, equipment and materials to be transported, stored, furnished, and other features applicable to completion of work.

B. Study drawings and specifications, report inconsistencies, errors, omissions, conflicts with codes and ordinances.

C. Submittal of a bid shall indicate Contractor has examined site and Drawings and has included all required allowances in his bid. No allowance shall be made for any error resulting from Contractor's failure to visit job site and review Drawings. Bid shall include costs for all required Drawings and changes as outlined above.

D. Be fully informed regarding any, and all peculiarities and limitations of spaces available for installation of all work and materials furnished and installed under the Contract. Exercise due care to assure that all parts of this work are easily accessible.

E. All dimensions shall be taken from interior drawings, certified equipment drawings and from the structure itself before fabricating any work. All space requirements shall be verified, coordinating with other trades, as it is the various Contractors' responsibility to install the system complete in the space provided without extra charge to the Owner.

F. It is intended that anything, whether labor or materials, which is usually furnished as a part of any equipment specified and which is necessary for the best operation shall be furnished as a part of the contract without additional cost, whether or not shown or described.

G. All equipment shall be installed in accordance with manufacturer's recommendations unless approval is given in writing by the Architect for deviation.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

A. MATERIALS AND EQUIPMENT
1. Any reference in these specifications and/or on the drawings to any article, device, product, material fixture, form, or type of construction by name, make or catalog number, shall be interpreted as establishing a minimum standard of quality.
2. Unless otherwise specified, provide only new, first grade equipment and materials which comply with requirements of this Specification and applicable Standards.
3. Similar items of material and equipment shall be product of same manufacturer.
4. Under no circumstances shall materials, equipment or components of the mechanical systems intended for use on this project contain asbestos in any form. Contractor shall submit written certification of compliance with this provision upon request from the Engineer.

B. BRANDS TO BE SUBSTITUTED
1. No substitution for brands named in the contract documents will be considered unless written request has been submitted to the Architect/Engineer. Each such request shall include a complete description of the proposed substitute, drawings, cuts, performance and test data, and any other data or information necessary for complete evaluation. The burden of proving acceptability of a proposed product rests on the party submitting the request for approval.

C. Request for approval of product substitutions shall be submitted in writing to the Engineer a minimum of ten (10) working days in advance of the bid date. **Request for approval received after the 10-day prior date shall be rejected.** All positive decisions for substitution approval shall be issued by addendum prior to bids.

D. All products shall bear the Underwriters Laboratories Inc. (UL) label.

E. Refer to individual sections for items to be furnished by the installing Contractor.

F. The Contractor or any vendor wishing to submit materials for prior approval shall include the form, Exhibit 1, entitled "Certification of Compliance - Prior Approval Request" found at the end of this section with each submittal. If the vendor does not indicate any exceptions to the specifications, he(she) asserts that his product will meet each, and every aspect (significant or insignificant) of the specifications. Failure to complete and execute the form will result in rejection of the submittal without review.

2.2 MACHINERY GUARDS

A. Provide guards for moving equipment such as fan belt drives and pump/motor drive couplings.

B. Use OSHA approved belt guards and coupling guards. Provide 1/2 inch hole in guard at center of shaft of driven equipment where belt type drives are used.

2.3 BOLTED CONNECTIONS

A. Accurately punch, drill, or ream bolt holes and remove burrs. Use washers, lock washers, and self-locking nuts as specified on Drawings, and as otherwise required. Tighten all bolts and nuts. Use screw threads conforming to National or Unified forms in accordance with Bureau of Standards Handbook H28. Do not use sheet metal screws. Use machine bolts where access or nuts would not be possible, and where unbolting may be required, in which case utilize sufficient thickness of metal to assure that 2 complete bolt threads are engaged. Secure machine bolts in place by proper lock washers.

2.4 MATERIALS FOR TESTING

A. All detergents, solvents and other cleaning agents shall be compatible with the materials of fabrication of the systems, in which they are used. They shall not adversely affect the materials or mechanisms in the system and they shall be acceptable to equipment manufacturers. All detergents, solvents and other cleaning agents shall also be compatible with the process streams to be handled by the system in which they are used.

B. Blinds, gaskets, bolts, etc., used in isolating segments of systems shall conform to the specification for adjacent materials.

C. Contractor shall furnish all labor, tools and equipment required for pressure testing piping systems.

2.5 MATERIALS FOR DISINFECTION OF POTABLE WATER SYSTEM

A. The disinfecting agent shall be one of the following: Sodium hypochlorite solution (commercially available bleach), calcium hypochlorite granules or tablets.

B. In every case, careful calculation of the chlorine concentration must be made, and the procedure must insure that adequate chlorine reaches all points of the system, and remains in contact for the required duration.

C. The disinfecting agent and procedure shall be as specified under disinfection procedure in Section 220500.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Plumbing work shall be under the direct supervision of a licensed Master Plumber, Class II.

B. Heating, Ventilating, and Air-Conditioning work shall be under the direct supervision of a licensed Conditioned Air Contractor, Class II.

C. The supervising license holders shall be identified, and a copy of their current valid license shall be provided as part of the initial submittal package.

D. License holders shall accompany Engineer on all required job site visits, and shall review and approve in writing, all shop drawings, and submittals prior to forwarding to Engineer for review.

E. Where piping or equipment is exposed to view, special attention shall be given to pipe routing and installation, and the finished installation shall be neat and workmanlike, straight, and parallel or perpendicular to the building construction. Piping exposed to view shall be primed and painted as directed by the Architect.

3.2 ELECTRICAL WORK

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics present on the site and specified in Division 26.

B. Motor controls, system controls, starters, pilot lights, push buttons, etc., shall be furnished complete as part of a motor apparatus which it operates. Provide individual automatic motor starters for all three phase motors and all single-phase motors. All fractional horsepower single phase motors shall have internal thermal overload protection, except where starters are scheduled. All components shall be in conformance with the requirements of the National Electrical Code (2017 Edition) and Division 26.

C. All power wiring and final connections to the system shall be provided under Division 26.

D. Control wiring shall be provided under Division 23.

E. Starters shall be as manufactured by General Electric, Type CR-306, or approved equivalent, by Square-D, Westinghouse, Allen-Bradley, or Furnas, subject to full compliance with all criteria. Use starters of only a single manufacturer throughout the project. Units shall have NEMA 1 enclosures, three thermal overloads for three phase equipment, and shall have auxiliary contacts and push button switches as required in the “HVAC Controls” section of these specifications. Mount motor starters in their own individual enclosures, or in a factory fabricated starter panel.

3.3 PRODUCT HANDLING, DELIVERY, AND STORAGE

A. Receive and handle all materials with care so as not to cause damage. Use padded or strap slings, etc., as appropriate for materials being handled. Lift equipment by lift points provided or recommended by manufacturer.

B. Use proper tools, equipment, and procedures to handle and lay pipe. Do not damage pipe coating, wrapping or linings. Repair or replace damaged pipe coatings, wrappings, or linings in accordance with manufacturer's instructions or as required to restore original protection.

C. Inspect all materials, upon receipt, for defects and for compliance with Specifications.

D. Properly store all pipe, piping materials, etc., so as to prevent deterioration while in storage. Store all materials off ground or off floor. Store inside or cover all materials subject to deterioration from weather.

E. Store loose materials such as fittings, gaskets, bolts, nuts, small valves, traps, and specialties in adequate number of bins to properly separate. Protect ends of large fittings, valves and pipe from weather and abuse. Properly grease all machined surfaces.

3.4 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All uninsulated black ferrous metal items exposed to sight such as equipment hangers, piping, frames and supports not provided with factory prime coat, shall be cleaned, and painted with one coat of rust inhibiting primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. Refer to Section 9 – "Painting", for additional requirements.

3.5 CLEANING AND ADJUSTING

A. The exterior surfaces of all mechanical equipment, fixtures, fittings, piping, ducts, etc., shall be cleaned of all grease, oil, paint, and other construction debris.

B. Start-up and adjustment of boilers shall be performed by the certified factory representatives of the respective equipment manufacturer.

C. Equipment controls and other accessories shall be adjusted to provide optimal and efficient operation.

3.6 TESTING

A. GENERAL
   1. Concealed or insulated piping and ductwork shall be tested in place before concealing or covering.
   2. Equipment, materials, and instruments required for tests shall be furnished without incurring additions to the Contract.
   3. Refer to the individual specification sections (for piping, ductwork, or equipment) for specific testing requirements regarding that item.

B. Upon completion of each phase of the piping systems, the system shall be flushed with a sufficient quantity of water or nitrogen to remove all foreign materials (flux, dirt, oil, etc.) which would be harmful to general public. It shall be the Contractor's responsibility to prevent accidental use of contaminated water by the building occupants.

C. Refer to Section 1 – "Quality Requirements", for additional requirements for water quality testing.

3.7 SHOP DRAWINGS

A. Submit a minimum of three hard copy sets of shop drawings along with an electronic formatted submittal for approval prior to commencing work. Hard copy shop drawings shall be bound in a

three-ring binder and shall include an index page with each item listed and referenced to sections with tabs. Tabs shall be cross referenced to index page. All shop drawings shall be prepared and submitted as a single package. NO SHOP DRAWINGS WILL BE CHECKED UNTIL ALL HAVE BEEN SUBMITTED. (HVAC controls submittals and any items with exceptionally long lead times that may affect the project completion date, as determined by the Engineer may be submitted separately). Electronic shop drawings shall be a single PDF file and formatted as required for hard copy submittals. Each section shall be a bookmarked (tabbed) link named to describe the section. (ELECTRONIC SHOP DRAWINGS NOT PROPERLY FORMATTED WILL BE RETURNED UNCHECKED.)

B. In addition to the requirements of specification section 01330, the following format shall be followed for Mechanical/Plumbing and Fire Protection Shop Drawing Submittals:

1. The binder cover shall include-
   Project Name
   Type of Shop Drawing including trade (HVAC, Plumbing, Fire Protection, etc.)
   Mechanical Contractor's Company Name
   Date of Submittal
2. The first sheet inside the binder shall include all items on the binder cover plus the following-
   Owner
   Architect
   Engineer
   Mechanical Contractor's Project Manager's Name
3. The second sheet shall be "Certification of Compliance - Shop Drawings -Exhibit No. 2".
4. Subsequent sheets shall include an index of all items included in the submittal, followed by submittal items.
5. Each individual submittal item shall be marked to show Specifications Section and Paragraph number which pertains to the item. Shop Drawings shall clearly indicate location, fixture no. or equipment designation, etc., so that the intended use of the equipment can be readily identified. Failure to make submittals accordingly shall be considered cause for rejection of shop drawings.

C. Submittals shall be supported by descriptive material, such as catalog cuts, diagrams, certified performance curves and charts published by the manufacturer to show conformance to specification and drawing requirements: model numbers alone will not be acceptable. All literature shall clearly indicate the specified model number, dimension, arrangement, rating, and characteristics of the proposed equipment. Capacities and ratings shall be based on conditions indicated or specified herein. Any deviations from specified equipment shall be clearly noted in red.

D. **The Contractor shall review the information prepared by his suppliers and note any changes required prior to submitting the information to the Engineer and shall include the form, Exhibit 2, entitled "Certification of Compliance - Shop Drawings" found at the end of this section with each submittal.**

E. **Failure to complete and execute this form will result in rejection of the submittal without review.**

F. The Engineer will review the shop drawings for errors in the Contractor's interpretation of the contract documents only. Corrections or comments made on shop drawings during review shall

not relieve the Contractor from compliance with requirements of the contract documents, plans and specifications. Review of shop drawings shall not relieve the Contractor from the responsibility for conforming and correlating all quantities and dimensions, coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

G. Review of shop drawings shall not permit any deviations from the plans and specifications nor shall it permit changes to the plans and specifications by the engineer. Changes to or deviations from the contract documents are subject to the provisions of the General Conditions of the contract. Any required changes will then be issued by the architect and executed by both the Owner and Contractor.

H. Shop drawings shall be submitted for each of the following items:
Backflow Preventers
Pipe and Pipe Fittings
Plumbing Fixtures & Fittings
Water Heaters & Accessories
Valves & Unions
Cleanouts & Accessories
Shock Arrestors
Pipe Identification Systems
Access Covers & Panels
Insulation & Accessories
Hangers, Supports & Accessories
Relief Valves
Valve Schedules and Diagrams
Thermometers
Pressure Gauges
Hydrants
Floor Drains
Electric Domestic Water Heaters
Domestic Hot Water Recirculating Pumps
Equipment Labeling

I. For miscellaneous items not listed here, Contractor shall submit shop drawings for approval, unless the item is to be provided and installed **exactly** as specified, without variance. Items not included in the shop drawing submittal data shall be provided and installed exactly as specified, without variance. Items not in compliance with this paragraph shall be removed and replace with specified materials and equipment, at the engineers' sole discretion.

J. Submit evidence of welders' qualifications prior to performing any welds.

K. **In addition, contractor shall prepare and submit dimensioned shop drawings (drawn at minimum 1/4"=1'-0" scale) of all ductwork, piping, and equipment (HVAC & plumbing) on the entire project. The drawings shall be created with computer aided drafting software. This shall also include actual mechanical room layouts, typical sections through corridors, pipe sleeves and other penetrations through slabs and walls for HVAC & plumbing rough ins including fire and smoke walls. These shop drawings shall be submitted on bond or other reproducible media, along with a set of prints equal to the number of copies of submittals required by the Contract Documents.**

3.8 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Complete operating and maintenance instructions shall be provided to the Owner. Three separate copies shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic, and a sequence of operation.

B. Operating and maintenance instructions shall be included for the following equipment:

Electric Domestic Water Heaters
Domestic Hot Water Recirculating Pumps
Water Coolers

C. A system wiring and control diagram shall be included in the operating and maintenance instructions.

D. Equipment warranty information shall include model number, serial number, and date of installation.

E. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the owner in the operation of all systems for a period of not less than 8 hours, arranged at owner's convenience. Provide written certification showing personnel trained, dates and duration of training unless otherwise specified.

F. All keys, operating manuals, maintenance instruction manuals and parts information shall be turned over to the Owner.

G. Refer to Section 1 - Project Closeout and - Project Record Documents for additional requirements for O&M submittals.

3.9 GUARANTEE

A. All systems and components shall be provided with a minimum one-year guarantee, from the date of Substantial completion, except as specified below.

B. The guarantee shall cover all labor, materials, and workmanship. During this guarantee period, all defects in materials and workmanship shall be promptly corrected by repair or replacement without incurring additions to the Contract. Water heaters shall carry a 3-year commercial warranty covering all materials and labor.

3.10 COORDINATION

A. Coordinate requirements of the various components of the heating, ventilating, air conditioning, plumbing and fire protection systems specified herein. Supervise inter-connection and adjustment of these components so as to obtain a complete and functional system.

B. Coordinate work of this Division, including space requirements, with the work of other Divisions. All items installed above ceilings shall be located in such a manner to minimize necessary ceiling system component removal to attain access for maintenance and/or replacement.

C. All items mounted at or below the ceiling, and any item penetrating the ceiling, shall be coordinated with, and approved by the Owner. If any items are not shown on these plans, or any items need to be located for coordination purposes, prepare a plan, and submit to the Engineer for approval.

D. Where heat pump units and/or fan coil units are installed above ceilings, the Contractor shall coordinate the routing of domestic water piping, trap primer piping, sanitary waste and vent piping, and sprinkler piping to clear all unit access and service clearance areas below units. No sprinkler heads or branch piping shall be located in unit access spaces.

3.11 FIELD OBSERVATION VISITS

A. Give Owner 3 days advance notice of all tests and field observation visits. All visits by engineer shall be accompanied by the contractor's supervising license holder.

B. Conduct and document all tests to satisfaction of Owner.

C. Make site available at all times for review by Owner.

D. In addition, the following field observation visits by Owner or his authorized representative shall be conducted for each building or part of building and site.
   1. Above floor work before being concealed or covered.
   2. Final review after completion of work.

3.12 WORKMANSHIP

A. All equipment, materials, specialties, etc., shall be installed and connected in accordance with the best engineering practice and standards for this type work. The recommendations and written instructions of the manufacturer shall be followed for installing the work.

B. Contractor shall be experienced and fully licensed to perform construction of the type and class required under this contract. All work provided under this Division shall be installed under the direct supervision of contractors licensed by the State of Georgia. The supervising license holder shall be identified, and a copy of their current valid license shall be provided as part of the initial submittal package.

C. All workmen shall be skilled in the task assigned them.

D. Work shall be completed in a neat and workmanlike manner.

E. Should any dispute arise as to the quality or fitness of any material or workmanship, the final decision regarding its acceptability shall rest solely with the Engineer.

F. All welders shall be qualified by an independent testing agency and certified in accordance with the requirements of ASME Section IX of the Boiler and Pressure Vessel Code. Contractor shall furnish certification of welder's qualifications with shop drawings.

3.13 RECORD DRAWINGS

A. Record drawings shall be submitted that incorporate all changes to the contract, pre-bid, and post-bid. Reference each specification section for the required manuals.

B. As the work progresses, the Contractor shall maintain records and record all changes made daily on a set of contract mechanical drawings (HVAC, Plumbing & Fire Protection) during the progress of the work. The in-progress set of marked-up drawings, clearly showing the nature and extent of all changes, shall be maintained in the construction office at the site and clearly marked "Record Drawings". The "Record Drawings" shall be up to date and available for use at time of any job site visit by the Engineer or Architect. The completed "Record Drawings" shall be turned over to the Architect upon completion and acceptance of the work. Final payment and "close-out" of the project shall be dependent upon receipt and acknowledgment of the completed "Record Drawings".

C. The Engineer shall furnish to the Contractor electronic files in Revit format of the Contract Mechanical Drawings for the Contractors' use in preparing a final electronic copy of the record drawings of all changes made including all project addenda and change order modifications. Drawing changes shall be identified as follows:
   1. The affected change shall be identified in an enclosed clouded area of a consistent color not used to indicate the noted change.
   2. Each cloud shall have an identifier adjacent to the cloud identifying the date and origin of the change (i.e., 1-12-06, Construction Directive, 1-12-06, Change Proposal, 1-12-06, Field Coordination, etc.).

D. Submittal for electronic Record Drawings shall be made on compact disk in electronic format and accompany one (1) full size set of bond plots to Engineer black on white background. Plots shall be generated from the electronic files. Electronic file names and plot sheet numbering shall match Contract Document sheet numbering format.

E. FINAL PAYMENT AND "CLOSE-OUT" OF THE PROJECT SHALL BE DEPENDENT UPON RECEIPT AND ACKNOWLEDGMENT OF THE COMPLETED RECORD DRAWINGS.

F. Refer to Section 22 05 53 – Identification for plumbing Piping and Equipment for additional requirements for as built documentation for valves, cleanouts, and under slab piping.

G. Refer to Section 1 - Project Record Documents for additional requirements.

3.14 NOISE AND VIBRATION

A. The system when in operation, shall be free from noise and vibration. Loose items shall be secured and items such as duct dampers shall be installed and locked into position to prevent undue noise.

B. Water piping shall operate free of vibration, water hammer, whistling or objectionable noise.

3.15 EXCAVATION AND BACKFILL

A. Perform all excavation and backfilling for work included in this Division of the specifications.

B. EXCAVATION

1. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and the making of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Over-depths shall be backfilled as specified and with materials for backfilling as specified.

C. BACKFILLING AND COMPACTION
1. The trenches shall not be backfilled until all required pressure and/or leak tests on piping are performed and until the mechanical systems as installed conform to requirements specified in the several sections covering the installation of the various systems. Trenches shall be backfilled to the ground surface with clean, select native excavated material or other material that meets compaction requirements and as hereinafter specified. Pavement and base course disturbed by trenching operation shall be restored to its original condition.

D. PROJECT CLEANLINESS
1. The Contractor shall clean up and remove accumulated dirt, rubbish and surplus materials resulting from his operations and leave the work site in a neat and orderly condition at the end of each day.

E. PROTECTION OF EXISTING UTILITY LINES
1. Existing lines that are to be retained, as well as other lines installed during construction, shall be clearly marked, and outlined, protected from damage during the excavation and backfilling, and if damaged, repaired by the Contractor immediately, without incurring an increase in cost to the contract. Damages resulting from the interruption or breakage of utility services shall be the responsibility of this contractor.

3.16 CUTTING, PATCHING, CARPENTRY & MASONRY WORK

A. Contractor shall do all cutting, patching, carpentry, and masonry work for work under this division to suit job progress. All patching shall conform to surrounding surfaces in every respect, including painting and tiling. No cutting or patching shall be performed without first obtaining written approval from the Owner. Cutting and patching of new concrete or masonry shall be avoided wherever possible.

3.17 SUPPORTS & SUPPLEMENTARY STEEL

A. All supplementary supporting steel for work under this Division shall be provided under this Division of the specifications in accordance with the plans and accepted practices. Refer to section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment for supports and supplemental steel requirements. All equipment, piping and ductwork supports shall comply with the seismic design requirements for Design Category B, Risk Category III.

3.18 FLASHING

A. All pipes, ducts, flues, etc., passing through a roof shall be installed in a manufactured curb assembly and flashed in a manner approved by the Architect. Flashing shall be perfectly watertight. Flashing for pipe penetrations through roof shall be 24" square, min. 6.0 lb/sq. ft. premanufactured adjustable lead flashing boots for built-up or modified bitumen roofing systems.

For single ply roofing systems, use premanufactured flashing boots as manufactured by the roofing system manufacturer.

B. All cutting and repairing of roof shall be performed by qualified roofers and shall employ materials and methods as required to leave roofing in equal or superior condition as existed before the commencement of work.

3.19 MINIMUM REQUIREMENTS

A. Code requirements are minimum and shall be complied with at no additional cost. Where requirements of these drawings and specifications exceed code requirements, work shall be furnished and installed in accordance with drawings and specifications. Any work done contrary to these requirements shall be removed and replaced without incurring additional costs to the Contract.

3.20 FREEZE PROTECTION

A. Inspect all drawings carefully for locations subject to freezing conditions. Do not install piping in exterior walls, ventilated attic or ceiling spaces, or other locations where freezing may occur. Pipe drops to exterior hydrants shall be installed inside of building insulation.

B. Piping systems throughout the building shall be protected from freezing, generally by installing pipes on the heated side of building insulation. Piping adjacent to exterior walls shall be installed in furred spaces with building insulation between the piping and the exterior wall.

C. In attic or ceiling spaces where building insulation batts are installed on the ceiling, piping shall be installed as low as possible to the ceiling, to allow the building insulation batts to be draped over the piping. Insulation of piping shall not in itself be considered freeze protection.

3.21 EXISTING UTILITIES

A. Where the information is available at the time of design, the plans indicate the approximate location, type, and sizes of various utilities within the site, where known. These utilities are indicated as accurately as possible from information available at the time of design.

B. If this Contractor encounters any utilities during construction which are not shown on the drawings, he shall ask for direction from the General Contractor. This Contractor shall assume all responsibility for protection of all utilities encountered, whether shown or not and for repair of same where required by this construction.

C. Notify all utility protection companies, utility companies, or other agencies which under normal circumstances might have utility lines in the area. All existing underground utilities shall be clearly identified on the surface of the ground prior to the commencement of underground utility work under this contract.

3.22 ACCESS DOORS AND PANELS

A. Furnish an access door for each condensate drain riser where shown on plans. Size as required for access, 12" x 12" minimum.

B. Also, provide access doors in all non-removable ceilings and in partitions and walls where necessary to maintain access to fire dampers, manual dampers, valves, shock arrestors and other mechanical devices requiring access. Size as required for uninhibited access to the equipment, whether for adjustment, operation, or replacement.

C. Access doors installed in fire rated construction shall be U.L. Listed to carry an approved fire rating for such construction.

D. Provide all access doors to the General Contractor for incorporation into the building construction in a timely manner.

3.23 CLOSE-OUT DOCUMENTS

A. Lead content certification: The contractor shall submit documentation of lead-free content of potable water system pipe, fittings, and accessories. This documentation shall state that the lead content in the domestic water system complies with governing code and the local Health Department criteria. **A test sample shall be taken at selected potable water outlets such as faucets, water coolers, sinks or other fixtures where drinking water may be obtained. Samples shall be sent the local health department or other testing lab for analysis of lead content. Submit written documentation of each test of the potable water system.**

B. Record drawings: Submit record drawings to the architect upon project close-out.

C. Operation and Maintenance Manuals shall be submitted with project close-out documents.

D. Submit acknowledgments of Owner's personnel instruction for operation and maintenance of the various systems.

E. Utility meter readings shall be submitted on the Substantial Completion Date prior to utility turn-over to the Owner.

F. Refer to Section 1 – Project Closeout for additional requirements.

SECTION 220500 - Exhibit No. 1

CERTIFICATION OF COMPLIANCE - PRIOR APPROVAL REQUEST

To:

Project:

I have reviewed the contract documents, including but not limited to specifications, drawings, and addenda. To the best of my knowledge the enclosed submittals (circle the appropriate statement); 1) are consistent with and meet the requirements of the aforementioned documents, or 2) are consistent with and meet the requirements of the aforementioned documents with the following exceptions (attach additional pages if necessary):

I further recognize that; 1) the engineers review is for general conformance with the design concept and with the information given in the contract documents, 2) approval of the submittals, by the engineer, unless specifically noted is for "manufacturer only" and specific requirements shall be as specified, including standard specifications as listed in the manufacturer's data for the actual product specified, 3) approval of the submittals shall in no way be construed to permit any deviations from plans and specifications.

To the best of my knowledge, substitution of the enclosed items will (circle the appropriate statement) 1) not require any modifications to any other element of the project, or 2) require the following modifications (attach additional pages if necessary:

I understand that I will be required to remove and replace at no additional cost to the owner any item found to be inconsistent with or not meet the requirements of the aforementioned documents.

The undersigned states that the above is true to the best of his knowledge and that his has the authority to legally bind his firm to the above terms. Failure to provide a legally binding signature shall void the prior approval request.

By: _____ Date:_____

Title: _____

Company:_____

SECTION 220500 - Exhibit No. 2

CERTIFICATION OF COMPLIANCE - SHOP DRAWINGS

To:

Project:

I have reviewed the contract documents, including but not limited to specifications, drawings, addenda, and change orders. To the best of my knowledge the materials described by the enclosed shop drawings are consistent with and meet the requirements of the aforementioned documents. I further recognize that; 1) the engineers review is to assist me in complying with the documents by checking for errors in my interpretation of the requirements set forth in the contract documents, 2) review of shop drawings, by the engineer, shall not relieve me of my responsibility for confirming and correlating all quantities, dimensions and work with that of other trades, and for performing the work in a safe and satisfactory manner, and 3) review of shop drawings, by the engineer, shall not permit any deviations from plans and specifications.

I understand that I will be required to remove and replace at no additional cost to the owner any item found to be inconsistent with or not meet the requirements of the contract documents.

The enclosed submittal (shop drawings) has been reviewed for accuracy of equipment and system quality and component quantities. The available voltages have been coordinated with the electrical contractor. All coordination items with other trades have been completed including structural, electrical, and other mechanical division disciplines prior to ordering any equipment.

The undersigned states that the above is true to the best of his knowledge and that he has the authority to legally bind his firm to the above terms. Failure to provide a legally binding signature shall void submittal.

SubContractor:

By: _____ Date: _____

Ga. State License No. (Required) _____

Title:_____

Company: _____

General Contractor: _____

By:_____ Date:_____

Title:_____

Company: _____

Publications and Standards of the following organizations are referenced in these specifications:

American Gas Association
1515 Wilson Boulevard
Arlington, Virginia 22209

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
1791 Tullie Circle, N.E.
Atlanta, Georgia 30329-2305

American Society of Mechanical Engineers (ASME)
United Engineering Center
345 East 47 Street
New York, New York 10019

American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, Pennsylvania 19103

American Water Works Association, Inc. (AWWA)
6666 West Quincy Avenue
Denver, Colorado 80235

American Welding Society (AWS)
2501 N.W. 7th Street
Miami, Florida 33125

Cast Iron Soil Pipe Institute
1499 Chain Bridge Road
McLean, Virginia 22101

Copper Development Association, Inc.
405 Lexington Avenue
New York, New York 10174

Ductile Iron Pipe Research Association (DIPRA)
245 Riverchase Parkway East
Birmingham, Alabama 35244

Manufacturer's Standardization Society (MSS)
127 Park Street, N.E.
Vienna, Virginia 22180

National Fire Protection Association (NFPA)
Battery March Park
Quincy, Massachusetts 02269

Sheet Metal and Air Conditioning
Contractor's National Association,
Inc. (SMACNA)
8224 Old Courthouse Road
Tyson's Corner, Vienna, Virginia 22180

Southern Building Code Congress
International (SBCCI)
900 Montclair Road
Birmingham, Alabama 35213-1206

Underwriters Laboratories (U.L.)
333 Pfingsten Road
Northbrook, Illinois 60062

END OF SECTION 22 05 00

SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Bimetallic-actuated thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.

B. Related Sections:
1. Section 223300 "Electric Domestic Water Heaters" for thermometers at electric domestic water heaters inside the building.
2. Section 221119 “Domestic Water Piping Specialties” for pressure gages at building service entrance pressure reducing valve (PRV) stations inside the building.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For thermometers and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ashcroft Inc.
   2. Marsh Bellofram.
   3. Trerice, H. O. Co.
   4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   5. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel or cast aluminum with 9-inch nominal length.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel or brass.

G. Window: plastic.

H. Accuracy: Plus or minus 1 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:
   1. Standard: ASME B40.200.
   2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   3. Material for Use with Copper Tubing: CNR.
   4. Type: Stepped shank unless straight or tapered shank is indicated.
   5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
   6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
   7. Bore: Diameter required to match thermometer bulb or stem.
   8. Insertion Length: Length required to match thermometer bulb or stem.
   9. Lagging Extension: Include on thermowells for insulated piping and tubing.
   10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMETEK, Inc.; U.S. Gauge.
      b. Ashcroft Inc.

c. Trerice, H. O. Co.
d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: +/- 0.5%.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

F. Install valve and snubber in piping for each pressure gage for fluids.

G. Install test plugs in piping tees where called for on plans.

H. Install thermometers in the following locations:
1. Domestic water heater supply.
2. Domestic hot water circulating return lines.

I. Install pressure gages in the following locations:
   1. Domestic water service entrance.
   2. Domestic water pressure reducing valve assembly.

3.2 CONNECTIONS

A. Install thermometers and gages adjacent to water heaters and equipment to allow service and maintenance of water heaters and equipment.

3.3 ADJUSTING

A. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 220519

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes valves for plumbing piping systems, inside the building.

B. All work in this section is subject to the provisions of Section 220500.

C. Provide all design documents, piping, fittings, valves, and labor for installation of the plumbing systems indicated on the drawings and specified herein.

1.2 SUMMARY

A. This Section includes the following general-duty valves:
1. Bronze angle valves.
2. Copper-alloy ball valves.
3. Ferrous-alloy ball valves.
4. Bronze check valves.
5. Gray-iron swing check valves.
6. Ferrous-alloy wafer check valves.
7. Spring-loaded, lift-disc check valves.
8. Bronze globe valves.

B. Related Sections include the following:
1. Division 220553 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:
1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.
   1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. All valves used in domestic water piping systems shall meet the Reduction of Lead in Drinking Water Act, Federal Act S.3874 for lead content.

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 valves open to minimize exposure of functional surfaces.
   5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   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 manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:
1. Hand wheel: For valves other than quarter-turn types.
2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
1. Valve Grooved Ends: AWWA C606.
2. Solder Joint: With sockets according to ASME B16.18.
a. Caution: Use solder with melting point below 840 deg F. for angle, check, and globe valves; below 421 deg F. for ball valves.
3. Threaded: With threads according to ASME B1.20.1.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Available Manufacturers:
1. Type 1, Bronze Angle Valves with Metal Disc:
a. Crane Co.; Crane Valve Group; Stockham Div.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
2. Type 2, Bronze Angle Valves with Nonmetallic Disc:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Grinnell Corporation.
e. Hammond Valve.
f. NIBCO INC.
3. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Div.
d. Grinnell Corporation.
e. Milwaukee Valve Company.

B. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy hand wheel.

C. Type 1, Class 150, Bronze Angle Valves: Bronze body with bronze disc and union-ring bonnet.

D. Type 2, Class 150, Bronze Angle Valves: Bronze body with nonmetallic PTFE or TFE disc and union-ring bonnet.

E. Type 3, Class 150, Bronze Angle Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

2.4 COPPER-ALLOY BALL VALVES

A. Acceptable Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves (1/2" thru 2-1/2"):
   a. Conbraco Industries, Inc.; Apollo Div.; 77CLF 100/200.
   b. Crane Co.; Crane Valve Group; Crane Valves; 9201/9202.
   c. Hammond Valve; UP8311A/8313A.
   d. Milwaukee Valve Company; UP450/450S.
   e. Kitz Valve Company; 868/869
   f. Nibco

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Bronze body with full-port, chrome-plated ball; PTFE or TFE seats; and 600-psig CWP rating and blowout-proof stem.

2.5 FERROUS-ALLOY BALL VALVES

A. Acceptable Manufacturers:
   1. Conbraco Industries, Inc.; Apollo Div.
   2. Cooper Cameron Corp.; Cooper Cameron Valves Div.
   3. Crane Co.; Crane Valve Group; Stockham Div.
   4. Hammond Valve.
   5. Milwaukee Valve Company.
   6. Nibco

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 300, full port.

2.6 BRONZE CHECK VALVES

A. Manufacturers:
   1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
      a. Cincinnati Valve Co.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Walworth Co.
   2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
      a. Cincinnati Valve Co.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
   3. Type 3, Bronze, Swing Check Valves with Metal Disc:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. Powell, Wm. Co.
      h. Walworth Co.
      i. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

D. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

E. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

F. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

G. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

H. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.7 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:
   1. Type I, Gray-Iron Swing Check Valves with Metal Seats:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. Mueller Co.
      h. Watts Industries, Inc.; Water Products Div.
   2. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Div.
      c. Mueller Co.
      d. Watts Industries, Inc.; Water Products Div.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type I, Class 250, gray-iron, swing check valves with metal seats.

D. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.

2.8 FERROUS-ALLOY WAFER CHECK VALVES

A. Manufacturers:
   1. Single-Plate, Ferrous-Alloy, Wafer Check Valves:
      a. McWane, Inc.; Kennedy Valve Div.
      b. Mueller Co.
      c. Tyco International, Ltd.; Tyco Valves & Controls.
   2. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Div.
      c. Grinnell Corporation.

d. Watts Industries, Inc.; Water Products Div.

3. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Gulf Valve Co.
   c. Valve and Primer Corp.
4. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Gulf Valve Co.
   c. Techno Corp.

B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

C. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.

D. Single-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

E. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.9 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Manufacturers:
1. Type I, Wafer Lift-Disc Check Valves:
   a. Mueller Steam Specialty.
2. Type II, Compact-Wafer, Lift-Disc Check Valves:
   a. Grinnell Corporation.
   b. Hammond Valve.
   c. Metraflex Co.
   d. Milwaukee Valve Company.
3. Type III, Globe Lift-Disc Check Valves:
   a. Grinnell Corporation.
   b. Hammond Valve.
   c. Metraflex Co.
   d. Milwaukee Valve Company.
4. Type IV, Threaded Lift-Disc Check Valves:
   a. Grinnell Corporation.
   b. Metraflex Co.
   c. Milwaukee Valve Company.
   d. Watts Industries, Inc.; Water Products Div.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.

D. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

E. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.

F. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.10 BRONZE GLOBE VALVES

A. Manufacturers:
   1. Type 1, Bronze Globe Valves with Metal Disc:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. Powell, Wm. Co.
      h. Walworth Co.
   2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. Hammond Valve.
      f. McWane, Inc.; Kennedy Valve Div.
      g. Milwaukee Valve Company.
      h. Powell, Wm. Co.
      i. Walworth Co.
   3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Grinnell Corporation.
      e. Hammond Valve.
      f. Milwaukee Valve Company.
      g. Walworth Co.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.

C. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball or butterfly valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:
1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 250, cast iron.
3. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
8. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
9. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 250, cast iron.
10. Gate Valves, NPS 4 and Larger: Type I, Class 250, OS&Y bronze-mounted cast iron.
11. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
12. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.

G. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-soluble, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work specified in this section is subject to the provisions of Section 220500.

B. Pipe hangers, trapeze type hangers, upper attachments and other supports shall be selected based on pipe size, insulation or covering (if applicable), and in strict accordance with MSS SP-69. Provide all hangers and rods, turnbuckles, angles, channels, and other structural supports to support the piping systems. Rods for pipe hangers shall be as follows:

HANGER ROD DIAMETER	PIPE SIZE
3/8"	2" and smaller
1/2"	2-1/2" and 3"
5/8"	4" and 5"
3/4"	6"
7/8"	8", 10" and 12"

C. Intermediate pipe supports provided between building structural members so as not to exceed maximum support spacing specified shall be structural steel angles (minimum 2-1/2" X 2-1/2" X 1/4").

D. All ferrous metal pipe hangers and supplemental steel shall be provided with factory applied coat of rust inhibitive paint, plating, or galvanizing.

E. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit around the pipe, pipe insulation and pipe insulation protective shields.
1. Cold water piping
2. Domestic hot water supply and recirculating piping
3. Condensate drainage piping

F. All supporting equipment shall be designed with a minimum factor of safety of five based on the ultimate tensile strength of the materials employed.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Pipe supports and installations shall comply in every respect to MSS-SP-68, SP-69, and SP-89. Supports shall be manufactured by Anvil International, Michigan Hanger Co. or PHD.

B. Pipe Supports for the types Horizontal Piping listed below shall be MSS Type 1 as manufactured by Anvil No. 260, Michigan Hanger No. 400, or PHD No. 450.
1. Soil Piping
2. Waste Piping

3. Vent Pipe
4. Domestic Hot and Cold Water

C. SUSPENDED HORIZONTAL PIPING

Support Spacing

NOMINAL PIPE SIZE	MATERIAL	MAXIMUM SPACING OF SUPPORTS--FT
Up through 1-1/2"	Steel & Copper	6'-0"
2" through 8"	Steel & Copper	8'-0"
3" through 5"	Cast Iron	5'-0"
6" and above	Cast Iron	5'-0"

In addition to the above maximum spacing requirements, hangers and supports shall be installed within 18" of each change in direction, regardless of pipe size or material.

D. Pipe supports for Floor Supported Horizontal Piping suspended from steel structure.

E. Pipe supports for horizontal piping supported on concrete floors and on concrete bases shall be adjustable pipe saddle support with U-bolt and screwed floor flange. Bolt floor flange to floor and bases utilizing all bolt holes. Adjustable pipe saddle supports shall be steel (MSS Type 37) and shall be Michigan Hanger No. 721, Anvil No. 259 or PHD No. 882. Use foam glass inserts at all saddles, sleeves, etc.

F. Pipe Supports for Vertical Piping

1. Supports for all pipes shall fit directly around the pipe, and on insulated pipes, the support shall be insulated and provided with vapor barrier.
2. Vertical pipes passing through floors shall be provided with a riser clamp at each floor and at a minimum of one intermediate point between each floor (max. 18" from change in direction). Riser clamps shall have steel lugs, 1/4" thick X 2" high X 1-1/2" long, welded to the clamp arms so that clamp does not come in contact with the pipe sleeve. The lugs shall support the clamp from the floor.
3. Riser clamps shall be steel (MSS Type 8) and shall be Michigan Hanger No. 510, Anvil No. 261 or PHD No. 550. Riser clamps for copper tubing shall be copper plated: Michigan No. 511, Anvil No. CT121, or PHD No. 552.
4. Offset pipe clamps shall be steel and shall be Michigan Hanger No. 700, Anvil No. 103 or PHD No. 535. Offset pipe clamps for copper tubing shall be isolated from contact with copper tubing with insulating tape.

G. Pipe Insulation Protective Shields and Saddles for Horizontal Piping.
1. Provide galvanized sheet metal pipe insulation protection shields at each pipe hanger for all horizontal insulated water pipes and condensate drainpipes. Shield sizes shall be:
Pipes 2" and smaller: 18-gauge X 12" long
Pipes 2-1/2" and larger: 16-gauge X 18" long
Shields shall be 180-degree type at all pipe hangers, except that on trapeze hangers, pipe rack and on floor supported horizontal pipe shields shall be 360-degree type. For pipe sizes 2-1/2" and larger, use Foamglass (Class C insulation) inserts at all shields, hangers, sleeves, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe hangers and supports shall be installed in complete conformance with the manufacturer's recommendations, MSS SP-89, and the Contract Documents.

END OF SECTION 220529

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 APPLICABILITY

A. All work specified in this Section is subject to the provisions of Section 22 05 00.

B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take off, and 20'-0" maximum spacing on straight pipe runs.

C. Provide and install at each location of control or shut off valve installed above lay-in ceilings with a label maker identification tape attached to the permanent ceiling grid immediately below each valve. Background shall be clear, and adhesive backed. Valve identifier lettering shall be black 3/8 inch high or larger.
   1. Domestic cold water – CW- (tag number)
   2. Domestic hot water and recirculating hot water – HW- (tag number)

PART 2 - PRODUCTS

2.1 PIPE MARKINGS

A. Manufactured, pre-printed markings shall be used in accordance with the following:
   1. No tape or self-adhering markings will be allowed.
   2. Snap on pipe markers, Bradmark, Seton, Brady or approved equal are acceptable.
   3. For larger sizes, markers shall be strapped on with nylon fasteners.
   4. Markers shall be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

2.2 VALVE TAGS

A. GENERAL

1. Each gate valve, butterfly valve, plug valve, globe valve, ball valve, etc., shall have a valve tag affixed to the valve body. Valve tags shall be a minimum of 19-gauge brass, a minimum of 1-1/4" in size, and shall have identification numbers stamped into the tags. Valve tag shapes and numbering shall be as follows:

SYSTEM	SHAPE	IDENTIFICATION NUMBERS
Cold Water (Domestic)	Round	CW-1,2,3, ...
Hot Water (Domestic)	Round	HW-1,2,3, ...

2. Each valve tag shall be attached to the hand wheel or lever handle with jack chain or S hooks.
3. A valve chart, framed under glass and wall mounted, shall be located in the main mechanical room and shall list each valve by identification number, its location in the piping system - (i.e., hot water, fire main, water heater, etc.) and its function- (i.e., shut-off, balancing, drain, etc.).

PART 3 - EXECUTION

3.1 BAND AND LETTER SIZE

A. Band and letter sizes shall conform to the following table:

O.D. of Piping of Covering:	Width of Color Band	Size of Letter/Numbers
1" and smaller	6"	1/2"
1/4" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
8" and larger	18"	2"

3.2 IDENTIFICATION

A. Band legend and color and letter color shall conform to the following table:

Piping	Band Legend	Letters	Band Color
Domestic Cold-Water	CW	White	Green
Domestic Hot Water	HW	Black	Yellow
Hot Water Circulating	HWC	Black	Green
Non-Potable Water	NPW	White	Green

3.3 SPACING

A. Provide markers at maximum 20'-0" O.C. or otherwise at each wall penetration (one side only).

B. A minimum of one marker is required in room where walls extend to structure.

END OF SECTION 22 05 53

SECTION 220700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this Section is subject to the provisions of Section 22 05 00, Common Work Results for Plumbing.

B. This Section specifies general requirements for insulation of hot and cold piping surfaces subject to heat loss, heat gain or condensation or for purposes of personnel protection or noise reduction. This includes piping installed in walls and in pipe chases.

C. Refer to the SCHEDULE OF INSULATION SYSTEMS at the end of this section for applicability insulation systems for the various piping system types.

1.2 REFERENCES

A. Industry standards governing this work, except as otherwise noted:

NFPA 255: Method of Test of Surface Burning Characteristics of Building Materials.

ASTM B 209: Aluminum-Alloy Sheet and Plate.

ASTM E 84: Test for Surface Burning Characteristics of Building Materials.

Underwriters' Laboratories UL 723 surface burning characteristics of building materials.

1.3 REQUIREMENTS

A. All pipe insulation material shall have a permanent composite insulation, jacket and adhesive with a fire and smoke hazard rating as tested by procedure ASTM-E84, NFPA 255, and UL 723 not exceeding:

Flame Spread	25
Smoke Developed	50

B. The use of staples for securing insulation will not be permitted.

C. Insulation shall be applied on clean, dry surfaces. All insulation shall be continuous through pipe hangers, walls, ceiling openings, and sleeves. Insulation shall be installed in walls and in chases for all domestic hot and cold-water piping.

D. Ends of fiberglass pipe insulation on cold-pipe lines shall be sealed off with white vapor barrier coating at valves and fittings, and on straight runs of piping.

E. Unions shall not be insulated.

F. Accessories, such as adhesives, mastic, cements, tapes, and glass cloth for fittings shall have same component ratings as listed above. Accessories used shall be as recommended by manufacturer supplying insulation.

G. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

H. Any treatment of jackets or facings to impart flame-and-smoke safety shall be permanent. Use of water-soluble treatments is prohibited.

I. Contractor shall certify in writing prior to installation that all products to be used will meet above criteria.

1.4 DELIVERY, STORAGE AND HANDLING

A. All insulation materials shall be delivered and stored in manufacturer's container and kept free from dirt, water, chemical, and mechanical damage. All packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and all samples required for approval shall have a manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.5 SUBMITTALS

A. Manufacturer's Literature: Required data shall include but not necessarily be limited to:

Thickness of insulation
Density
External and internal facing
Maximum and minimum temperature ratings.
Fire and smoke ratings
Thermal conductivity
Permanence rating
Description of adhesives, cements, and tapes
Description of mechanical fastening systems.
Description of finishing and flashing materials and methods
Installation instructions

PART 2 - PRODUCTS

2.1 CLASSIFICATION OF INSULATION SYSTEMS

A. The following method of classifying the various piping systems is employed throughout this section of the specifications:

DESIGNATION	BRIEF DESCRIPTION
Class A	Preformed Sectional Glass Fiber

2.2 MATERIALS

A. Substitutions:

1. Detailed requirements for insulation are specified under each individual insulation class. Products of equal quality will be acceptable from the following manufacturer's, subject to review and approval by the Engineer:
   Owens-Corning
   Certain-Teed
   Johns-Manville
   Knauf
   Armstrong
2. Accessories used shall be as recommended by manufacturer supplying insulation.

B. Bands:
   1. On Aluminum Jacket: 3/8 inch by 0.020 inch thick aluminum.
   2. On Insulation Below Ground: 3/4 inch by 0.020 inch thick stainless steel.

C. Jackets:
   1. Insulation jackets shall not support mold growth.
   2. Aluminum Jacket: Corrugated, embossed or smooth sheet, 0.016 inch nominal thickness: ASTM B 209, temper H14, Type 3003, 5005 or 5010. Jackets shall be provided with moisture barrier.
   3. All Service Jacket (ASJ): Jacket shall be white washable laminate of aluminum foil and white kraft reinforced with a glass fiber scrim (white finish).

D. Insulation thickness:
   1. 1” thick for all domestic hot and cold-water piping.
   2. 1/2” thick for app condensate drain piping insulation.

2.3 QUALITY ASSURANCE

A. Work Summary:
   1. Thickness of insulation shall be as listed in the attached Piping Insulation Schedule or as shown on Drawings.
   2. Insulation thicknesses indicated in attachments or on Drawings are minimum allowable. Contractor shall ensure that thicknesses comply with applicable codes.
   3. Insulation shall not be applied until all pressure testing has been completed, inspected, and released for insulation application. Surfaces to be insulated shall be clean and dry.
   4. Whenever insulated vertical piping is located in such a manner that personnel or moving equipment may damage the insulation, protect insulation with 20-gauge aluminum sheet metal for a height of seven feet above the floor.
   5. Wherever hot piping not otherwise insulated is located such that it may be contacted by personnel, apply to piping one inch thick minimum insulation of sufficient thickness to reduce surface temperature to 130 degrees F.

2.4 CLASS A INSULATION:

A. Preformed Sectional Glass Fiber
   1. Fiberglass material with fine glass fibers bonded together with an inert thermosetting resin.
   2. Insulation shall be in preformed sections for pipe, with all service jacket and factory applied self-adhesive longitudinal caps and butt strips.

B. Characteristics:
   1. Density (pounds/cubic feet): Four minimum.

2. Thermal Conductivity ("k" factor (BTU-inch/square foot-hour-degrees F) at 75 degrees F. mean): 0.23 maximum.
3. Maximum Temperature Limit (degrees F): 450.
4. Minimum Temperature Limit (degrees F): 0.
5. Fittings shall be provided with PVC fitting covers equal to Manville "Zeston 2000", Proto or Ceelco

C. Class A Trade Names:
Certainteed 500 Degrees Snap On
Manville Micro-Lok
Owens Corning Heavy Duty Pipe Insulation

PART 3 - EXECUTION

3.1 APPLICATION

A. Installation instructions as specified herein are general requirements only. Apply all insulation, adhesives, and finishing materials strictly in accordance with manufacturer's recommendations or instructions.

B. Provide qualified superintendent to supervise application of all insulation materials. Use mechanics skilled in trade to perform work.

C. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint strips furnished with insulation.

D. Install insulation and finishes according to manufacturer's recommendations. Clean and dry surfaces before insulation is applied. Cut and fit insulation around irregular surfaces and apply covering tight and smooth.

E. Use insulation with continuous unbroken vapor seal on all cold surfaces where vapor barrier jackets are used. Insulate and vapor seal hangers, supports, anchors, or other items that are secured directly to cold surfaces to prevent condensation.

F. Protect insulation from physical damage at points of support where insulation must carry load imposed by support. Coordinate this requirement with types of hanger and support used.

G. Do not use partial lengths of any type of insulation where full length will fit.

H. Fill all voids with broken insulation of the same material being used or with insulating cement.

I. Fitting insulation shall conform to the same type and thickness and shall be applied in the same manner as prescribed for adjacent pipe unless otherwise specified.
1. Insulation for fittings on pipe two inches and smaller shall consist of a built-up layer of insulating cement, prefabricated (mitered) sections or sections built-up from segmented or block insulation.
2. Insulation for fittings on pipe 2-1/2 inches and larger shall consist of prefabricated (mitered) sections or sections built-up from segmented or block insulation.

J. All insulation shall fit the surface of the pipe snugly and shall be fabricated or molded so as to leave not more than 1/16 inch void between the surface to be insulated and the insulation itself. All insulation joints shall be close fitting.

K. Flash all metal protrusions through hot insulation, to prevent entrance of water.

L. For all metal protrusions through cold insulation, provide vapor seal.

M. Make all joints close fitting and watertight. Extra care is necessary in the application of cold insulation to maintain a vapor tight seal.

N. Unless otherwise noted, insulate all flanges and valves conforming to the same type and thickness as the adjacent pipe.

O. Extend segments of flange insulation a minimum of two inches beyond bolt ends and fill voids with insulating cement.

P. Where fabricated mitered segments of pipe insulation are used, cover them with 1/8 inch thick coat of insulating cement to make a smooth finish.

Q. Butt joints and seams of insulation shall be sealed with contact adhesive as recommended by the insulation manufacturer.

R. All domestic water piping installed in walls and/or chases shall be protected from mortar. Piping shall be cleaned prior to installation of insulation. Pipes not scheduled to be insulated shall be protected by polyethylene sleeves or protective wrap.

S. All insulation exposed to view shall be coated with two complete coats of mastic and made ready for final painting as directed by the Architect.

END OF SECTION 220700 (EXCEPT FOR ATTACHED PIPING INSULATION SCHEDULE)

PIPING INSULATION SCHEDULE

SERVICE	SYMBOL	INSULATION CLASS	THICKNESS
Non-Potable Water	NPW	A	1/2"
Cold Water (Domestic)	CW	A	1"
Hot Water (Domestic)	HW	A	1"
Circulating Hot Water	HWC	A	1"

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this section is subject to the provisions of Section 22 05 00.

1.2 SUMMARY

A. This Section includes domestic water piping inside the building.

B. Related Sections include the following:
1. Division 2 Section "Water Distribution" for water-service piping outside the building from source to the point where water-service piping enters the building.
2. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.
3. Division 22 Section General-Duty Valves for Plumbing" for valves in the domestic water piping systems.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Water Samples: Specified in Part 3 "Cleaning" Article.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store PEX tubing in original packaging or under cover to avoid dirt or foreign material from being introduced into the tubing.

C. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are

encountered, installer is responsible for providing UV protection to portions of tubing exposed to direct sunlight.

1.7 WARRANTY

A. PEX Manufacturer's Warranty: Warranty shall conform to the following:
   1. PEX tubing and fittings shall carry a twenty-five (25) year non-prorated warranty against failure due to defect in material or workmanship.
   2. All tubing manufacturer's valves and stops shall carry a one (1) year non-prorated warranty against failure due to defect in material or workmanship.
   3. The assembly of manufacturer's tubing and fittings shall carry a twenty-five (25) year non-prorated warranty on maintaining a leak-proof seal.
   4. Warranty shall provide for repair or replacement of any tube, fittings, or connection, which are proven to be defective and pay for consequential damages.
   5. Warranty shall be transferable to subsequent owners.
   6. Warranty Period: Warranty shall commence on Date of Substantial Completion.

PART 2 – PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. All PEX tubing, fittings and fitting assembly shall be by one manufacturer.

C. All PEX tubing, PEX rings and PEX fittings from the same manufacturer have been tested together and certified as a system.

D. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
   2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
   3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
   4. Manufacturers:
      a. Cambridge Lee
      b. Howell Metal
      c. Cerro Flow Products

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Manufacturers:
   a. Cambridge Lee
   b. Howell Metal
   c. Cerro Flow Products

C. Wrought Copper and Copper Alloy Solder Joint Pressure Fittings:
   7. Copper Pressure Fittings: ASME/ANSI standard B16.18 cast copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
   8. Wrought-copper fittings must be NSF/ANSI 61 registered.
      a. Cello Products
      b. Elkhardt Products
      c. Mueller Industries
   9. Press fitting joints may be used for pipe sizes 2-1/2" and larger.

2.3 PEX POTABLE WATER DISTRIBUTION SYSTEM

A. Tube Materials: Tube shall be cross-linked polyethylene (PEX) manufactured by PEX-A or peroxide method.
   1. PEX tubing shall be ASTM F876 tested and approved for excessive temperature and pressure for 725 hours at 210 degrees F (99 degrees C) @ 150 psi (1035 kPa).
   2. PEX tubing shall be listed to both NSF/ANSI 14 and 61.
   3. Pre-Sleeved Tubing: All PEX tubing that is incased in concrete shall be pre-sleeved. Pre-sleeved tubing shall be supplied by the PEX tubing manufacturer.
   4. Manifold Materi als: Manifolds shall be manufactured of Engineered Polymers (EP).
      a. Manifold connections shall be made to the requirements of ASTM F1960.
      b. Manifold Type: Uponor Engineered Polymer (EP) manifold.
   5. Multi-Port Tee Materials: Multi-Port Tee's shall be manufactured of Engineered Polymers (EP). Multi-Port Tee connections shall be made to the requirements of ASTM F1960.
      a. Multi-Port Tee's shall be supplied by the PEX tubing manufacturer.
      b. PEX-a cold expansion type manifolds shall be an assembly consisting of insert and PEX-a cold expansion ring.
      c. Multi-Port Tee Type: Uponor Engineered Polymer (EP) Multi-Port Tee.
      d. Fitting Materials: Fittings shall be manufactured of Engineered Polymer (EP). Lead free brass materials are allowed only for transition fittings. Fitting connections shall be made to the requirements of ASTM F1960.
   6. Polymer Fitting Type: Uponor Engineered Polymer (EP) fittings.
   7. Brass Fitting Type: Uponor lead free brass fittings.

B. Manufacturers:
   1. Uponor Ltd.
   2. Viega.
   3. IPEX.

4. Rehau.

2.3 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing."

B. Balancing and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

PART 3 – EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform all excavation and backfilling for work included in Division 22 of the specifications.

3.2 EXCAVATION

A. Excavations shall be performed in strict accordance with latest OSHA regulations. Sheeting, bracing, barricades, and fencing shall be installed wherever necessary to avoid undue hazards to workmen or passersby.

B. During excavation, material shall be piled at a distance from the banks of the excavation that will avoid overloading and will prevent slides and/or cave-ins. Water accumulating in excavations shall be removed by pumping. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled under sidewalks and curbs where pipe can be installed as specified and back-fill can be tamped. All trenches and pit excavations shall be shored and/or braced as required to prevent slides and/or cave-ins.

C. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and the making of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Over-depths shall be backfilled as specified and with materials for backfilling as specified.

3.3 BACKFILLING

A. The trenches shall not be backfilled until all required pressure and/or leak tests on piping are performed and until the mechanical systems as installed conform to requirements specified in the several sections covering the installation of the various systems. Trenches shall be backfilled to the ground surface with clean, selected excavated material or other material that meets compaction requirements and as hereinafter specified. Pavement and base course disturbed by trenching operation shall be restored to its original condition.

B. Backfill material shall be deposited in 6-inch-thick layers and compacted with mechanical tamps to the density of the adjacent soil or grade until there is a cover of not less than 2 feet over pipes. The backfill material in this portion of the trench shall consist of earth, sandy clay, soft shale, or other materials free from objects larger than 1 inch in any direction.

C. The remainder of the trench shall be backfilled with clean, select material that is free of stones larger than 3 inches in any direction. Backfill material shall be deposited in layers not exceeding 6 inches thick, and each layer shall be compacted mechanically. Settling of granular, non-cohesive material with water will be permitted. The surface shall be mounded over for settling and left in a uniform condition.

3.4 COMPACTION AND TESTING

A. Areas under building locations, paving, walks or other structures which may be placed on site at a future date shall be compacted to 95% minimum dry proctor.

A.5 PIPE AND FITTING APPLICATIONS

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 may be used on aboveground piping, unless otherwise indicated.

C. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 2 Section "Water Distribution."

C. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter up through slab to PEX manifold if allowed by owner, NPS 3/4" and Smaller: Soft copper tube, Type K; copper pressure fittings; no joints below slab.

D. Aboveground Domestic Water Piping: Use the following piping materials:
   1. Hard copper tube, Type L; copper pressure fittings; and soldered joints..
   2. PEX type A only after obtaining owner's approval.

E. Non-Potable-Water Piping: Use the following piping materials for each size range:
   1. 1-1/2 and Smaller: Soft copper tube, Type K; copper pressure fittings; and soldered joints. No joints below slab.
   2. PEX type A only after obtaining owner's approval.

3.6 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use bronze ball valves for piping 3" and smaller.
   2. Throttling Duty: Use full port bronze ball valves for piping 2" and smaller.
   3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
   4. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use full port ball valves for piping 4" and smaller.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Install hose-end drain valves at low points in water mains, risers, and branches.
   2. Install stop-and-waste drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping 2" and smaller. Balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

3.7 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install steel pipe sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall into occupiable spaces. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

F. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 22 Section "Domestic Water Piping Specialties."

F. Install domestic water piping level and plumb.

H. Manufacturer’s bend supports shall be used where bends are less than 6 times outside pipe diameter for PEX piping at slab on grade to below floor. PEX tubing passing through structural concrete slabs shall be pre-sleeved. Install continuous copper tracer wire on exterior piping below grade.

3.8 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Soldered Joints: Use ASTM B 813, water-soluble, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. PEX piping shall be joined using the manufacturers tools for cold compression expansion joining methods. All fitting connections to the PEX tubing shall be made to the requirements of ASTM F1960.

3.9 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1-1/2: 72 inches with 3/8-inch rod.
   3. NPS 2 thru NPS 3: 96 inches with 1/2-inch rod.
   4. NPS 4 thru NPS 6: 96 inches with 5/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow 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, and extend and connect to the following:
   1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
   3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected, tested, and approved by authorities having jurisdiction (AHJ), the Owner, and the Building inspections department.
2. Notification of Inspections shall include the Architect, Engineer, Building Inspections Department (AHJ) and the Owner. A notification of at least 48 hours shall be given before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction. All reports shall be submitted to the Architect with any required corrective action listed once test is completed.

B. Test domestic water piping as follows:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. 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.
   3. 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.
   4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four (4) hours. Leaks and loss in test pressure constitute defects that must be repaired.
   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.

3.12 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 flow of hot water in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Contractor shall provide signage at all potable water outlets where systems or portions of systems are being tested with date and duration of test(s) prior to commencement of disinfection procedure. Notification of system cleaning shall be sent to the Architect's office 24 hours prior to actual performance of work. A copy of the biological examination of the test results shall be sent to the Architect's office for review and approval.

B. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours. Open and close all valves in system several times during the retention period.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time. Open and close all valves in the system several times during the flushing period.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 CERTIFICATION OF STERILIZATION

A. All piping sterilization procedures shall be certified by collecting samples from randomly selected potable water outlets (10 minimum) and submitting them to the Local Health Department for analysis. Written results of water tests shall be submitted with the close out documents. NOTE: FINAL CLOSE OUT AND PAYMENT SHALL BE DEPENDENT UPON THE RECEIPT OF SATISFACTORY TEST RESULTS FROM THE LOCAL HEALTH DEPARTMENTS' TESTING LAB.

3.15 PRESSURE TESTS FOR PIPING SYSTEMS

A. Refer to Schedule of Piping Systems at the end of this section for required test pressures and durations.

B. Tests, including the inspection of all joints, shall be made to the satisfaction of the Owner's Representative. Following the completion and approval of the test, restore all components of the system to normal operation condition.

C. A report of pressure tests on each piping system shall be forwarded in duplicate to the Owner. This report shall show date of test, lines tested, test medium, length of time test pressure was held, pressure drop or rise, and extent of venting or re-pressurizing. Project superintendent shall observe testing methods and witness satisfactory performance of all piping systems. Certification of all tests performed shall be signed and dated by the testing personnel and the superintendent.

D. Defects in the piping shall be reworked and repaired and retested until proven tight. Concealed work shall be tested as a partial system before being concealed or insulated.

E. Water piping for inside domestic water systems shall be subjected to a hydrostatic test as outlined without leaks or loss of pressure with the pressure source disconnected.

G. Outside underground water piping shall be subjected to a hydrostatic test as outlined with leakage not to exceed 2 quarts per hour per 100 joints irrespective of pipe diameter. The amount of leakage shall be measured by maintaining the test pressure with a pump pulling from a calibrated or weighted container.

H. Indirect waste lines including air conditioning drain lines shall be temporarily capped or plugged and filled with water (before insulation is applied) and visually inspected for leaks.

3.16 INSPECTIONS

A. Inspections as required by local building authorities shall be held and certificates of inspection delivered to the Owner.

B. The Owner's Representative reserves the right to make any inspections. The Contractor shall give the Owner's Representative free access to his work, and whenever requested, shall furnish him with full information as to the progress of the work and its various parts at place of fabrication or on the job site. Such inspection shall not relieve the Contractor from full responsibility for the quality and correctness of his work.

C. If the specification, Owner's Representative's instructions, ordinances, law, or any other public authority requires any special tests or approval, the Contractor shall give the Owner's Representative timely notice of his readiness for inspection. If the inspection is by an authority other than the Owner's Representative, the Owner's Representative shall be informed as to the place and date fixed for such inspections.

END OF SECTION 221116 (EXCEPT FOR THE ATTACHED SCHEDULE)

SCHEDULE OF PIPING MATERIALS AND TESTS

SERVICE	SYMBOL	TEST PRESSURE	TEST DURATION
Domestic Cold-Water (Inside, above ground)	CW	100 psig	2 Hrs.
Domestic Hot Water	HW	100 psig	2 Hrs.
Circulating HW	HWC	100 psig	2 Hrs.

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1. 1 DESCRIPTION

A. All work in this section is subject to the provisions of Section 22 05 00.

B. Provide all design documents, piping, fittings, valves and labor for installation of the Plumbing systems indicated on the drawings and specified herein.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:
1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure reducing valves.
4. Strainers.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Water hammer arresters.
9. Trap-seal primer valves.
10. Individual tempering valves.
11. Outlet boxes.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

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. NSF Compliance:
1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 – PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cash Acme.
      b. Conbraco Industries, Inc.
      c. Zurn Plumbing Products Group; Wilkins Div.
   2. Standard: ASSE 1001.
   3. Size: As required to match connected piping.
   4. Body: Bronze.
   5. Inlet and Outlet Connections: Threaded or sweat.
   6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cash Acme.
      b. Conbraco Industries, Inc.
      c. Woodford Manufacturing Company.
   2. Vacuum breakers shall be provided on all outlets threaded for hose ends. Vacuum breakers shall be the screw on vandal proof type with hose outlet threads.

2.2 BACKFLOW PREVENTER

A. Double Check Valve Assembly Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Wilkins
      b. Conbraco Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
   2. Standard: ASSE 1015.
   3. Pressure Rating: Initial working pressure of 150 psig.
   4. Size: As shown on plans.
   5. Body: Bronze body, lead free construction, two positive seating check modules with captured springs and rubber seat discs. The check module seats and seat discs shall be repaceable. The assembly shall also include two resilient seated isolation valves and top mounted resilient seated test cocks.

2.3 WATER PRESSURE-REDUCING VALVES (PRV)

A. Water Regulators:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Wilkins
      b. Conbraco Industries, Inc.
      c. Watts Industries, Inc.; Water Products Div.
   2. Standard: ASSE 1003.
   3. Pressure Rating: Initial working pressure of 150 psig.
   4. Size: As shown on plans.

5. Body: Bronze body, lead free construction with removable strainer, threaded connections and renewable seats. Provide stainless steel spring, stainless steel adjusting screw and stainless-steel screws and fasteners throughout.
6. Flow rates and reduced pressure fall-off shall be within limits set by the applicable plumbing code.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve

2.5 HOSE BIBBS

A. Hose Bibbs (HB):
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 WALL/YARD HYDRANTS

A. Exterior Non-freeze Wall Hydrants (NFWH):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Woodford Manufacturing Company
   d. Wade Industries
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, stainless steel with flush mounted hinged cover.
9. Box and Cover Finish: Cast bronze with polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

B. Exterior Non-freeze Yard Hydrants (NFWH):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Woodford Manufacturing Company
   d. Wade Industries
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining yard hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Bury depth 24".
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: rough bronze with flush mounted hinged cover.
9. Box and Cover Finish: Cast bronze with polished nickel bronze.
10. Outlet: in ground, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

C. Interior Wall Hydrants (WH):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Woodford Manufacturing Company.
   d. Wade Industries
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants, less non-freeze features.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: stainless steel with flush mounted hinged cover.
8. Box and Cover Finish: polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for full-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer Arresters (WHA or SA):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MIFAB, Inc.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Zurn Plumbing Products Group; Specification Drainage Operation.
      d. Watts Industries
      e. PPP, Inc. SBHA series
   2. Standard: PDI-WH 201.
   3. Type: Metal bellows. Piston type arrestors are not acceptable.
   4. Size: PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES (TP)

A. Supply-Type, adjustable pressure drop activated, automatic.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Watts LFTP-300
      b. PPP Inc. P1
      c. Mifab
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   2. Standard: ASSE 1018.
   3. Pressure Rating: 125 psig minimum.
   4. Body: Brass
   5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   7. See plans for application and locations.

2.10 INDIVIDUAL FIXTURE, WATER TEMPERING VALVES

A. Individual-Fixture, Water Tempering Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Lawler Manufacturing Company, Inc. – 911E/F
      b. Leonard Valve Company. – TA-300
      c. Powers; a Watts Industries Co. – ES 150
   2. Standard: ASSE 1071 and ANSI Z358.1, thermostatically controlled water tempering valve.
   3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   4. Body: Bronze body with corrosion-resistant interior components.
   5. Temperature Control: 60-95 degrees range adjustable with internal cold-water bypass.
   6. Inlets and Outlet: Threaded.
   7. Finish: Rough or chrome-plated bronze.
   8. Tempered-Water Setting: 105 deg F.

2.11 OUTLET BOXES

A. Icemaker Outlet Boxes: P-902
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acorn Engineering Company.
Oatey.
Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate. Metal boxes shall be installed in rated walls with boxes rated for that installation.
4. Valve: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 globe, or ball valve and NPS 1/2 copper, water tubing.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve.

F. Install water hammer arresters in water piping according to PDI-WH 201 and accessible above ceilings. Install access panels where required in hard ceilings.

G. 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. Valve shall be installed above accessible ceilings.

H. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

K. Install trap primer lines in masonry walls with continuous polyethylene sleeves.

L. Install 1/2” double check valve assembly for ice machine cold-water supply above ceiling between isolation ball valve and drop in wall to utility box.

M. Install 1/2” check valve on hot and cold-water supplies above ceiling between isolation ball valve and drops in wall to mop receptor faucet or service sink faucet.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding."

C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Dual-check-valve backflow preventers.
   2. Water pressure-reducing valves.
   3. Trap primer distribution units.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable discharge pressure to trap primer regulators to 20 psi delivery pressure.

END OF SECTION 221119

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:
   1. Pipe, tube, and fittings.

1.2 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
   2. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:
   1. Include plans, elevations, sections, and details.

C. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888, for above grade sanitary waste and vent. All pipe and pipe fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF.

1. Manufacturers:
   a. Charlotte Pipe
   b. Tyler Pipe
   c. AB&I

B. Shielded Couplings: ASTM 1540 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
   1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
      a. Manufacturers:
         1) Clamp-All Corp. - Model 80
         2) Ideal Div.; Stant Corp. – Heavy Weight
         3) Husky – SD-2000
         4) Tyler Pipe; Soil Pipe Div.

2.4 PVC PIPE AND FITTINGS

A. Pipe and Fittings: Solid-Wall PVC Pipe, ASTM D 2665, sanitary drain waste and vent piping below slab on grade.
   1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.
      a. Manufacturers:
         1) Charlotte Pipe & Foundry Co.
         2) Sanderson
         3) Lasco
         4) Tigre

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
   1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
      a. Manufacturers:
         1) Cambridge Lee
         2) Howell Metal
         3) Cerro Flow Products

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Perform all excavation and backfilling for work included in Division 22 of the specifications.

3.2 EXCAVATION

A. Excavations shall be performed in strict accordance with latest OSHA regulations. Sheeting, bracing, barricades, and fencing shall be installed wherever necessary to avoid undue hazards to workmen or passersby.

B. During excavation, material shall be piled at a distance from the banks of the excavation that will avoid overloading and will prevent slides and/or cave-ins. Water accumulating in excavations

shall be removed by pumping. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled under sidewalks and curbs where pipe can be installed as specified and back-fill can be tamped. All trenches and pit excavations shall be shored and/or braced as required to prevent slides and/or cave-ins.

C. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and the making of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded. Over-depths shall be backfilled as specified and with materials for backfilling as specified.

3.3 BACKFILLING

A. The trenches shall not be backfilled until all required pressure and/or leak tests on piping are performed and until the mechanical systems as installed conform to requirements specified in the several sections covering the installation of the various systems. Trenches shall be backfilled to the ground surface with clean, selected excavated material or other material that meets compaction requirements and as hereinafter specified. Pavement and base course disturbed by trenching operation shall be restored to its original condition.

B. Backfill material shall be deposited in 6-inch-thick layers and compacted with mechanical tamps to the density of the adjacent soil or grade until there is a cover of not less than 2 feet over pipes. The backfill material in this portion of the trench shall consist of earth, sandy clay, soft shale, or other materials free from objects larger than 1 inch in any direction.

C. The remainder of the trench shall be backfilled with clean, select material that is free of stones larger than 3 inches in any direction. Backfill material shall be deposited in layers not exceeding 6 inches thick, and each layer shall be compacted mechanically. Settling of granular, non-cohesive material with water will be permitted. The surface shall be mounded over for settling and left in a uniform condition.

3.4 COMPACTION AND TESTING

A. Areas under building locations, paving, walks or other structures which may be placed on site at a future date shall be compacted to 95% minimum dry proctor.

3.05 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping 6" and smaller shall be the following:
   1. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Copper DWV tube, copper drainage fittings, and soldered joints.
   3. Schedule 40, solid wall, PVC piping, solvent socket weld DWV fittings.

C. Aboveground, sanitary vent piping 4" and smaller shall be the following:
   1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
   2. Schedule 40, solid wall, PVC piping, solvent socket weld DWV fittings.

D. Underground, soil, waste, and vent piping 6" and smaller shall be the following:
   1. Schedule 40, solid wall, PVC piping, solvent socket weld DWV fittings.

3.6 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

E. 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 2 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.

F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
   1. Building Sanitary Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller or 2 percent where called for on plans; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow or 2 percent where called for on plans.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. No horizontal piping shall be installed in the slab.

3.7 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.8 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Install individual, straight, horizontal piping runs according to the following:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.
      c. Longer than 100 feet, if indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch 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: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6: 60 inches with 3/4-inch rod.
   5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod.
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   3. NPS 2-1/2: 108 inches with 1/2-inch rod.
   4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
   5. NPS 6: 10 feet with 5/8-inch rod.
   6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above in accordance with MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.10 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 48 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. Water test sanitary drainage and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without

introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.11 CLEANING

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.

END OF SECTION 221316 (EXCEPT FOR THE ATTACHED SCHEDULE)

SCHEDULE OF PIPING MATERIALS AND TESTS

SERVICE	SYMBOL	TEST PRESSURE	TEST DURATION
Sanitary Waste Drain (below grade)	W	10' static HD	1 Hr.
Sanitary Soil Drain (below grade)	S	10'static HD	1 Hr.
Sanitary Vent (below grade)	V	10' static HD	1 Hr.
Sanitary Waste Drain (above slab)	W	10' static HD	1 Hr.
Sanitary Soil Drain (above slab)	S	10'static HD	1 Hr.
Sanitary Vent (above slab)	V	10' static HD	1 Hr.
Trap Primer Tubing	TP	Available Head	30 Min.
Condensate Drains	CD	5' Head	2 Hrs.

SECTION 221319

DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All work in this section is subject to the provisions of Section 22 05 00.

B. Provide and install all piping accessories as shown on the drawings and as specified for completion of fully functional plumbing or fire protection systems.

1.2 SUMMARY

A. This Section includes the following drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Miscellaneous drainage piping specialties.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cleanouts shall be provided where shown on the drawings, and as required by the applicable plumbing code. All floor cleanouts shall have access cover and cleanout plugs removed at the time of final project review. It is the contractor's responsibility to coordinate location and elevation of floor cleanouts with casework. Wall cleanouts shall not be installed in the sanitary sewer system.

B. Cleanouts on under floor drainage piping shall have piping extended to the floor and finished with cleanout plug and removable floor plate. Minimum size of floor cleanouts is 3".

C. Cleanouts shall not be installed in carpeted areas.

D. Cleanouts in waterproofed and overhead floors shall have flashing clamp and flange.

E. Cleanouts in vertical piping shall be roughed with centerline not more than 1'-6" above the finished floor, but high enough for escutcheon cover to clear the baseboard.

F. For Walls: Cleanouts shall be no-hub cleanout tee with bronze countersunk plug tapped for machine screw with shallow stainless-steel face-of wall access cover.
   1. Jay R. Smith 4510-Y
   2. Josam 58790
   3. Wade 8560E
   4. Zurn Z-1446-BP
   5. Watts Drainage CO 460 RD

G. Concrete Floors: Cleanouts shall have cast iron body, adjustable round scoriated nickel bronze cover and rim, cast iron adjustment collar, stainless steel, philips head screws, and countersunk taper thread bronze plug.
   1. Jay R. Smith 4028C-U-PB
   2. Josam 56000-15-22
   3. Wade W-6010-75
   4. Watts Drainage CO-200-R.
   5. Zurn Z-N140

H. Yard Cleanouts: Cleanouts shall have tractor weight cast iron housing and countersunk bronze plug, vandal proof securing screw. Cleanouts shall be set in a 16" X 16" X 6" deep poured concrete pad set flush with grade.
   1. Jay R. Smith 4243-U
   2. Josam 56050-22
   3. Wade 7030-2
   4. Watts Drainage CO 200 RX-4-34B
   5. Zurn Z1474-N

I. A cleanout plug removal tool and a cleanout cover removal tool for each type of cleanout plug and cleanout cover shall be installed in the main mechanical room.

J. Immediately prior to Owner's final review, all wall and floor cleanout plugs shall be removed from cleanouts to assure Owner that cleanout plugs can be removed without any obstructions. Apply anti-seize lubricant to all threads of cleanout plugs and replace cleanout plugs and access covers immediately following Owner's final review.
   1. Acceptable manufacturers of anti-seize lubricants:
      a. Fel-Pro C5-A
      b. Rectorseal Break-out
      c. Lub-O-Seal Never-seez

2.2 TRAPS

A. Traps, other than those furnished as a part of the plumbing fixture, shall be as specified under plumbing fixtures, of same size as fixture tailpiece. Where not underground, traps shall be provided with cleanout plugs on the bottom.

2.3 FLOOR DRAINS (FD)

A. FD-1: Floor drains shall have a cast iron body and cast-iron flashing flange with adjustable 6" round nickel bronze strainer, sediment bucket, and stainless steel, philips head securing screws and trap primer connection.
   1. Jay R. Smith, 2010-A6-B-P050
   2. Josam, 30000-6A-50-80
   3. Mifab. F1000-5-7
   4. Wade, 1000-R6-27
   5. Watts, FD-100-A6-5-7
   6. Zurn, ZN-415-6B-P-Y

B. FD-2: Floor drain shall have coated cast iron body and cast-iron flashing flange, 7" round nickel bronze strainer with anti splash collar, sediment bucket.
   1. Jay R. Smith, 2010-A-F-37
   2. Josam, 30000-E1
   3. Mifab, F1100-ER7
   4. Wade, 1100-ER7
   5. Watts, FD-100-ER7
   6. Zurn, ZN415-7I

C. FS-1: Floor sink drain shall be cast iron body, acid resistant coated with 8-1/2" square nickel bronze top, dome bottom strainer, minimum 6" deep with 3" outlet. Provide top grate/cover options as called for on plans.
   1. Jay R. Smith 3100-13 (basis of design)
   2. Josam
   3. Mifab
   4. Zurn
   5. Wade
   6. Watts Drainage.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acorn Engineering Company; Elmdor/Stoneman Div.
      b. Thaler Metal Industries, Ltd
      c. Zilla Flashing Products, Inc.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 3 and smaller and 80 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.
   5. Cleanouts shall not be located behind casework or cabinets.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall. Install high enough for escutcheon cover to clear baseboard.

E. 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.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install deep-seal traps on all mechanical room floor drains and other waste outlets, where indicated on plans, or as required by Code.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

J. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

K. Install trap primer lines below slab on grade to pitch to drains. No joints shall be installed in trap primer lines below slab on grade. Trap primer lines below grade shall be wrapped and coated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. 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 22 13 19

SECTION 223300

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the following electric water heaters:
   1. Commercial, storage electric water heaters.
   2. Water heater accessories.

1.2 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For each type of commercial electric water heater, signed by product manufacturer.

C. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.4 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:

a. Faulty operation of controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Final Completion:
   a. Commercial Electric Water Heaters:
      1) Storage Tank: Three years.
      2) Controls and Other Components: One year.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

A. Commercial, Storage Electric Water Heaters: Comply with UL 1453 requirements for storage-tank-type water heaters.
   1. Manufacturers:
      a. Bradford White Corporation.
      b. Smith, A. O. Water Products Company.
      c. Rheem.
   2. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
      a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
         1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
         2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
      b. Pressure Rating: 150 psig.
      c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
   3. Factory-Installed Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
      c. Insulation: Comply with ASHRAE/IESNA 90.1.
      d. Jacket: Steel with enameled finish.
      e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
         1) Staging: Input not exceeding 60 kW per step.
      f. Temperature Control: Adjustable thermostat.
      g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
      h. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank. Relief valves shall be shipped with the heater from the factory.
   4. Special Requirements: NSF 5 construction.

5. Capacity and characteristics for water heaters are scheduled on the plans.

2.3 WATER HEATER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: Factory supplied, ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.

C. Drain Pans: Corrosion-resistant metal with 2” high minimum raised edge. Include dimensions not less than base of water heater plus 4” and include drain outlet not less than NPS 3/4.

2.4 SOURCE QUALITY CONTROL

A. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

B. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on level surfaces or on 4” high concrete pads as indicated on the plans.
   1. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing”.

B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls, nameplate, and devices needing service are accessible.

C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap into floor drain or service sink.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains, mop receptors, or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water piping Specialties" for hose-end drain valves.

E. Install thermometer on hot water outlet piping of water heaters.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low Voltage Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 22 33 00

SECTION 224000

PLUMBING FIXTURES

PART 1 – GENERAL

1.1 APPLICABILITY

A. All work specified in this Section is subject to the provisions of Section 22 05 00.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components. Refer to "Plumbing Fixture Schedule" found at the end of this section for basis of design fixtures and model numbers.
   1. Lavatory Faucets
   2. Flushometers.
   3. Toilet seats.
   4. Protective shielding guards.
   5. Fixture supports.
   6. Water closets.
   7. Wall-hung Lavatories
   8. Urinals.
   9. Mop receptor basins.
   10. Mop receptor Faucets
   11. Countertop sink faucets.
   13. Drop-in stainless-steel sinks
   14. Shower valves

B. Related Sections include the following:
   1. Division 10 Section "Toilet and Bath Accessories."
   2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers and specialty fixtures not included in this Section.
   3. Division 22 Section "Drainage Piping Specialties" for floor drains, cleanouts, and other indirect waste specialties.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. 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, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

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 the 2010 ADA Standards for Accessible Design for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
   2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
   3. Stainless-Steel Residential Sinks: ASME A112.19.3.
   4. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
   1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
   2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
   3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
   4. Faucets: ASME A112.18.1.
   5. Hose-Connection Vacuum Breakers: ASSE 1011.
   6. Hose-Coupling Threads: ASME B1.20.7.
   7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   8. NSF Potable-Water Materials: NSF 61.
   9. Pipe Threads: ASME B1.20.1.
   10. Supply Fittings: ASME A112.18.1.
   11. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:
   1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
   2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
   3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
   4. Faucets: ASME A112.18.1.
   5. Hand-Held Showers: ASSE 1014.
   6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
   7. Hose-Coupling Threads: ASME B1.20.7.
   8. Manual-Control Antiscald Faucets: ASTM F 444.
   9. Pipe Threads: ASME B1.20.1.
   10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

I. 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. Plastic Tubular Fittings: ASTM F 409.
   5. Brass Waste Fittings: ASME A112.18.2.

J. 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. Grab Bars: ASTM F 446.
   4. Hose-Coupling Threads: ASME B1.20.7.
   5. Off-Floor Fixture Supports: ASME A112.6.1M.
   6. Pipe Threads: ASME B1.20.1.
   7. Plastic Toilet Seats: ANSI Z124.5.
   8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. All fixtures and accessories shall be warranted against defects in materials and workmanship for a period of one year from date of acceptance by the Owner.

PART 2 – PRODUCTS

2.1 LAVATORY FAUCETS

A. Countertop Lavatory Faucets: P301H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Delta 22C151 (Basis of design)
      b. Moen Commercial
      c. Sloan
      d. Symmons

e. Zurn
f. American Standard

2. Dual deck mount, ADA compliant, chrome plated, 4-inch, center set, .5 gpm vandal resistant aerator.
3. Faucet shall have an unconditional warranty of 5 years. Warranty letter shall accompany product submittals.
4. Where hot water temperature provided exceeds 110 degrees Fahrenheit, provide point of use adjustable tempering valve under lavatory below faucet connections and set to 105 degrees Fahrenheit.

2.2 FLUSHOMETERS

A. Flushometers, P101, P101H, P201H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sloan Valve Company.
b. Zurn Plumbing Products Group; Commercial Brass Operation.
c. TOTO
2. Description: Manual flushometer for water-closet-type fixtures. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, polished chrome-plated finish on exposed parts and solid ring pipe support to wall for water closets. Provide ADA handle on accessible fixtures.
3. Provide solid ring supports on water closet flush valves. Solid ring supports are not required on urinal flush valves.
4. Basis of design – water closet flush valve; Sloan Regal 111-1.28XL
5. Basis of design – urinal flush valve; Sloan Regal 186-0.5XL
6. Flush valves for water closets shall be 1.28 gpf.
7. Flush valves for urinals shall be 0.5 gpf.
8. Coordinate installation of flushometer rough-in with grab bars in handicap stalls.

2.3 TOILET SEATS

A. Toilet Seats, P101, P101H:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Bemis Manufacturing Company. 1955SSCT
b. Church Seats.295SSCT
c. Olsonite Corp.10SSCT
2. Description: Toilet seat for water-closet-type fixture.
a. Material: Molded, solid plastic.
b. Configuration: Open front without cover.
c. Size: Elongated.
d. Hinge Type: SC, self-sustaining, check, with Sta-Tite commercial fastening system.
e. Class: commercial.
f. Color: White.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, P301H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. McGuire Manufacturing Co., Inc.
      b. Plumberex Specialty Products Inc.
      c. TRUEBRO, Inc.
      d. Zurn Industries
   2. Description: Manufactured plastic wraps for covering plumbing fixture hot and/or cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
   3. Where ADA skirt is installed under countertops, protective covers are not required.

2.5 FIXTURE SUPPORTS

A. All wall hung lavatories and water coolers shall be supported independently of the wall by a commercial floor mounted carrier consisting of rectangular steel uprights with welded feet and secured to floor with lead anchor inserts or self drilling expansion shields and lag bolts at each location. Wall brackets and conceal arms shall be provided where appropriate for fixture being supported. Leveling and locking hardware shall be provided for lavatory carrier concealed arm supports.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Josam Company.
   2. MIFAB Manufacturing Inc.
   3. Smith, Jay R. Mfg. Co.
   4. Zurn Plumbing Products Group; Specification Drainage Operation.
   5. Watts Drainage
   6. Wade

2.6 WATER CLOSETS

A. Water Closets, P101, P101H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard Companies, Inc.
      b. Kohler Co.
      c. Zurn
      d. Sloan
      e. Toto
   2. Description: Accessible, floor-mounting, floor-outlet, white, elongated, 1.28 gpf vitreous-china fixture designed for flushometer valve operation, top spud with brass floor mounting hardware and bolt caps.
   3. All water closet bowl gaskets between floor and waste pipe connection shall be a combination of wax seal with plastic or urethane reinforced flanged polyethylene sleeve permanently molded into gasket assembly.
      a. Oatey Model No. 31194
      b. Hercules Plumbing Products Johni-Ring Model No. 90-220
      c. Plastic Oddities Inc. Model BG-7k.

2.7 WALL HUNG LAVATORIES

A. Wall Hung Lavatories, P301H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard Companies, Inc.
      b. Kohler Co.
      c. Zurn
      d. Sloan
   2. Description: Accessible, wall-mounting, white, vitreous-china fixture with 1 or 3-hole drilling, nominal 20" x 18" with backsplash and drilled for concealed arm supports and mounted on commercial floor carrier.

2.8 URINALS

A. Urinals: P201H:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard.
      b. Kohler Co.
      c. Zurn Industries, LLC.
   2. Description: Accessible, wall-mounting, 2" back-outlet, vitreous-china fixture mounted on commercial floor carrier. 3/4” top spud, 1/8 gallon per flush.
   3. Urinal waste arms from fixture outlet to connection at stack shall be 2” schedule 40 to extend 2” beyond face of finished wall with FERNCO 2”x1-1/2” reducing coupling.

2.9 MOP RECEPTOR BASINS

A. Service Sink Faucets: P501:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Kohler “Whitby No. K-6710-0 (Basis of Design)
      b. Stern Williams
      c. Acorn Engineering Company
      d. Florestone Prodects Company
   2. Description: Flush-to-wall, floor-mounting, cast iron fixture with rim guard. 28" x 28" with 13" high curbs all around with 8” drop front. 3" drain outlet with grid strainer.

2.10 MOP RECEPTOR FAUCETS

A. Service Sink Faucets: P501:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. T & S Brass and Bronze Works, Inc.; B-0665-BSTP
      b. Speakman Company; SC-5812.
      c. Zurn Plumbing Products Group; Commercial Brass Operation; Z843M1-CS.
      d. American Standard; 8344012.002

2. Description: polished chrome plated, cast brass, integral check stops, vandal resistant four arm handles with color-coded indexes. Cast brass nozzle with 3/4" hose thread, pail hook and top brace. Brass vacuum breaker. Provided threaded brass wall escutcheon covers. ASSE-1001 compliant.

2.11 COUNTERTOP SINK FAUCETS

A. Sink Faucets, P610H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing Company.
      c. Kohler Co.
      d. Delta No. 120-LF (Basis of Design)
   2. Description: Kitchen faucet, three or four-hole fixture, faucet with or without hand spray. Include hot and cold-water indicators where required; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor. Faucets shall be furnished with 2.0 gpm vandal resistant aerators and 1/2" inlet shanks.

2.12 DROP-IN STAINLESS-STEEL SINKS

A. Sinks, P610H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing Company.
      c. Kohler Co.
      d. Moen, Inc.
   2. Description: Two compartment, drop-in, self-rimming, 18-gauge, 300 series stainless steel sink. Drilling, depth, and size as scheduled. See basis of design fixture schedule at the end of this section for specific sink requirements.

2.13 SHOWER VALVES

A. Sinks, P701H:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Speakman
      b. Leonard
      c. Symmons
      d. T&S Brass and Bronze Works
      e. Delta
   2. Description: Single-handle pressure-balance valve for shower. Include hot and cold-water indicators; check stops; temperature limit stops, shower head, arm, and flange. Coordinate faucet inlets with supplies.
   3. For handicapped accessible installation include hand-held spray with 60" stainless steel braided hose with wall mounted vacuum breaker and chrome escutcheon cover and 24" long slide bar with wall mounts and chrome escutcheon covers at wall. Provide diverter valve and chrome plated escutcheon cover at wall.

4. Shower head and valve mounting heights as indicated on the plans.

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. Coordinate countertop heights with Architectural plans and elevations.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Plumbing Valves."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system. Cleanout plug in trap shall be accessible for removal of plug.

J. Install flushometer valves for manually operated accessible water closets and rough in with handle mounted on wide side of compartment as applicable. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves. Faucet assemblies shall be set square to sinks and lavatories, with paired faucet handles set symmetrical in the off position.

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 deep escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

O. Set mop receptor basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

P. 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 7 Section "Joint Sealants."

Q. Miscellaneous wall mounted items such as hose bibs, wash down fittings and flush valves shall have supplementary steel angles and a steel mounting plate securely attached to the wall framing to provide rigid support.

R. Install 1/2" check valves on hot and cold-water supplies to mop receptor faucet overhead between isolation stop valves and pipe drops to fixture.

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. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers, cartridges and/or seals of leaking and dripping flush valves, 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 aerators and strainers, remove sediment and debris, and reinstall strainers and aerators.
   2. Remove sediment and debris from drains.
   3. Clean all floor drain grate tops and floor cleanout covers to like new condition.

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 22 40 00

(EXCEPT FOR THE ATTACHED PLUMBING FIXTURE SCHEDULE)

PLUMBING FIXTURE SCHEDULE

P101 Water Closet - Floor Mounted - Flush Valve - 1.28 GPF – Kohler “Wellcomme Ultra” No. K-96053 white vitreous china toilet, elongated siphon jet action bowl, two bolt caps, manual flush valve with solid ring pipe support attached to wall, and white solid plastic open front heavy-duty seat.

P101H Water Closet - Floor Mounted - Flush Valve - Handicap - 1.28 GPF – Kohler “Highcliff Ultra” K-96057 white vitreous china toilet, elongated siphon jet action bowl, two bolt caps, manual flush valve solid ring pipe support attached to wall, and white solid plastic open front heavy-duty seat.

P201H Urinal - Wall Hung – 0.5 GPF – Handicap - Kohler “Bardon” No. K-4991-ET-0, white vitreous china, siphon jet action with 3/4" top spud, 2" I.P.S. outlet, and manual flush valve, 3/4" spud, wall and spud flanges. Provide concealed floor mounted carrier, mount rim at 17" above finished floor.

P301H Lavatory - Wall Hung - Handicap - Kohler "Greenwich" No. K-2032 white vitreous china lavatory with concealed overflow, center set, single lever handle faucet with .50 gpm aerator, McGuire Model No. 155WC offset grid drain assembly, McGuire No. 8872C-DF 1-1/4" chrome plated P-Trap with brass nuts, cleanout plug, and deep wall escutcheon, McGuire No. H170LK chrome plated copper supplies with angle stops, loose tee keys, and deep wall escutcheons. Provide floor mounted carrier with concealed arms. Provide handicapped covers on offset drain, p'trap and both supplies; Truebro Model 103W or equal.

P501 Mop Receptor and Faucet – 28"x28" cast iron, porcelain enamel, floor mounted corner receptor with rim guard and faucet with hose. Mount faucet 48" AFF.

P610H Work Room Sink – Countertop - Double Compartment - Elkay Model No. LR-3319, 18 gauge type 304 stainless steel sink punched with 3 faucet holes on 4" centers, Elkay LK-35 cup strainers, 1-1/2" offset chrome plated tailpiece, and McGuire No. 8912C-DF - 1-1/2" chrome plated p-trap with brass nuts, cleanout plug and deep wall escutcheon, 8" center set sink faucet with hose and spray, swing spout and 1/2" inlet shank connections, McGuire No. LFH170LK loose key angle stops, chrome plated copper tube supplies and deep wall escutcheons. Install in countertops provided by others; coordinate required roughing heights with countertop heights as indicated. Provide handicapped covers on offset drain, p'trap and both supplies. Add dishwasher drain tailpiece where required for installation of undercounter dishwasher drains.

P701H Shower Fittings - Handicapped - Symmons Model 1-117-FS-B24-X-2 pressure balancing mixing valve with single lever handle, flexible hand spray hose with 24" adjusting bar and in-line vacuum breaker, shower head and diverting valve, escutcheon and 2.2 gpm flow control. Tile surround by others. Contractor shall provide and install required safe pan and 3" floor drain (FD-1) with flashing flange for watertight finished installation. Mixing valve control shall be mounted at 44" A.F.F. and with centerline at 12" from entry opening to comply with ANSI A117.1 (Federal Handicapped Accessibility Code). Factory set temperature limit stops on shower valve to 105° F.

P902 Ice Maker Box - Wall Mounted - OATEY Model No. 38681 metal icemaker box with stop valve installed, adjustable mounting straps and face plate.

SECTION 224700

DRINKING FOUNTAINS & WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following related components:
   1. Bottle Filling Stations.
   2. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.

B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.

C. Fitting: Device that controls flow of water into or out of fixture.

D. Fixture: Drinking fountain or water cooler unless one is specifically indicated.

1.4 SUBMITTALS

A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

B. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

B. NSF Standard: Comply with NSF 61 and 372 to meet Federal and State low-lead requirements., "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

C. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

1.6 WARRANTY

A. The complete water cooler and packaged water chiller unit inclusive of compressor, hermetically sealed refrigeration unit, water system, water regulator and electrical components shall be warranted be free from defects in material and workmanship for (1) year from the date of installation.

B. Contractor shall submit the warranty data sheets with serial numbers of each unit and date of installation with closeout documentation for record. For the second thru fifth years, the manufacturer shall warrant the compressor and the hermetically sealed refrigeration system, inclusive of the tank assembly when the part of the hermetically sealed refrigeration unit for an additional four years from the end of the initial one-year warranty period.

PART 2 - PRODUCTS

2.1 BOTTLE FILLING STATIONS

A. Bottle Filling Stations, P401BH:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay Model No. LZSTL8WSSP or a comparable vandal resistant product by one of the following:
      a. Oasis Manufacturing Co.
      b. Halsey Taylor.
      c. Murdock Inc.
   2. Description: Accessible, Style W, wall-mounting water cooler.
      a. Material: Stainless steel top, stainless steel cabinet finish.
      b. Receptor Shape: Rectangular.
      c. Bubblers: One, vandal resistant, with adjustable stream regulator, located on deck.
      d. Control: Push button.
      e. Bottle filler: Electronic sensor, no touch activation, automatic 20 second shutoff timer.
      f. Supply: NPS 3/8, stop valve with isolation ball valve above ceiling.
      g. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
      h. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.
      i. With visual filter monitor and high capacity filter.

2.2 FIXTURE SUPPORTS

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Josam Co.
   2. MIFAB Manufacturing, Inc.
   3. Smith, Jay R. Mfg. Co.
   4. Zurn Plumbing Products Group; Specification Drainage Operation.
   5. Watts Drainage.

C. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
   1. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use floor mounted carrier supports for wall-mounting fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping accessible above ceilings. Use lead free full port ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install type “A” water hammer arrestor/shock absorber above accessible ceiling between fixture isolation ball valve and drop in wall or chase to fixture.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

F. Seal joints between fixture and wall on top only using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants." Caulking shall not impede removal of accessible covers.

G. Fixtures shall be supported at bottom with toggle bolts thru wall.

H. Mount with bottle filler unit set at ADA height.

3.4 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. See plans for where new drinking fountains are to replace existing units. Coordinate with existing conditions. Modify waste rough is as required for new fixture setting height.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.6 CLEANING

A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 22 47 00 (EXCEPT FOR THE ATTACHED PLUMBING FIXTURE SCHEDULE)

PLUMBING FIXTURE SCHEDULE

P401BH Electric Water Cooler - Wall Hung - Handicapped – Hi/LoBottle Filling Station - vandal resistant unit with a minimum capacity of 8.0 gph of 50 degree water at A.R.I. standard conditions, bottle filling station, with wall hanger, vandal resistant push button control, 1-1/4" tailpiece, McGuire No. 2158LK angle stop and supply with deep escutcheon, McGuire No. 8872C-DF 1-1/4" p-trap with brass nuts, cleanout plug and deep wall escutcheon. Provide floor mounted concealed carrier and mount fixture with center of ADA bubbler at 36" above finished floor.

SECTION 230500

COMMON WORK RESULTS 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. See Editing Instruction No. 3 in the Evaluations for discussion about how this Section supplements other Division 23 Sections.

B. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. HVAC demolition.
3. Equipment installation requirements common to equipment sections.
4. Painting and finishing.
5. Concrete bases.
6. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

A. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

D. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

E. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

D. Coordinate locations of floor drains and floor cleanouts with HVAC Equipment pads and units in all mechanical equipment rooms, closets and platform areas. Coordination layout drawings shall be prepared and coordinated by all trades.

E. No mechanical, plumbing or fire protection equipment, ductwork or piping shall be located overhead within 42" of electrical switchboards or panelboards.

F. No water piping (HVAC, domestic, storm, sanitary, or sprinkler) shall be located above electrical switchboards or panelboards. If the governing authority requires fire sprinklers in the electrical rooms, spray shields shall be fabricated and installed to protect the live panels or switchboards from spray from sprinkler discharge.

G. Coordinate sanitary waste and vent stub ups and rainwater/downspout stub ups at slab on grade installations with structural plans to ensure that footings and/or grade beams are dropped or stepped to avoid piping penetrations thru footings and grade beams.

1.7 CODES AND REGULATIONS

A. All materials and workmanship shall comply with the latest editions of the following codes and standards, as applicable:

Manufacturer's Standardization Society (MSS) Standard Practice (SP) 58: Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69: Pipe Hangers and Supports - Selection and Application

MSS SP-69: Pipe Hangers and Supports - Fabrication and Installation Practices

National Fire Protection Association (NFPA) Pamphlet 13: Installation of Automatic Sprinkler Systems

NFPA 13: Installation of Sprinkler Systems

NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances

NFPA 30: Flammable and Combustible Liquids Code

NFPA 90A: Installation of Air Conditioning and Ventilating Systems

NFPA 90B: Installation of Warm Air Heating and Air Conditioning Systems

NFPA 96: Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment

NFPA 101: Safety to Life from Fire in Buildings and Structures

NFPA 211: Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

NFPA 231: General Storage

National Electrical Code, 2017 Edition

International Mechanical Code, 2018 Edition, with Georgia Amendments

International Energy Conservation Code, 2015 Edition, with Georgia Amendments

International Building Code, 2018 Edition, with Georgia Amendments

International Plumbing Code, 2018 Edition, with Georgia Amendments

International Fuel Gas Code, 2018 Edition, with Georgia Amendments

International Fire Code, 2018 Edition, with Georgia Amendments

All local prevailing County codes and Ordinances

B. All workmanship and materials shall comply with all ordinances and regulations of all local authorities having jurisdiction.

C. Contractor shall obtain all permits and licenses, and pay all fees, as required for execution of the contract. Arrange for necessary inspections required by City, County, State and other authorities having jurisdiction, and deliver certificates of approval to the Owner. In compliance with the Georgia State Boiler Code, it is the responsibility of the Contractor (at his expense) to have each boiler and/or applicable pressure vessel inspected by a State of Georgia certified inspector upon installation of this equipment.

D. This inspection report shall be submitted to the Georgia Department of Labor, Safety Engineering Section, 501 Pullman Street, Room 210, Atlanta, Georgia 30312, Attention Chief Safety Engineer.

E. Upon the Georgia Department of Labor review of the inspection report and their inspection, they will place a tag indicating the State Serial Number on the inspected piece of equipment and issue a certificate of boiler or pressure vessel inspection. The original certificate issued is to be posted in the main Mechanical Room, with a copy sent to the client and one copy is to be included in the closeout documents.

1.8 RECORD DRAWINGS

A. As the work progresses, the Contractor shall maintain records and record all changes made daily on a set of contract mechanical drawings (HVAC, Plumbing & Fire Protection) during the progress of the work. The in-progress set of marked-up drawings, clearly showing the nature and extent of all changes, shall be maintained in the construction office at the site and clearly marked “Record Drawings”. The “Record Drawings” shall be up to date and available for use at the time of any job site visit by the Engineer or Architect. The completed “Record Drawings” shall be presented to the Architect upon completion and acceptance of the work. Final payment and “close-out” of the project shall be dependent upon receipt and acknowledgment of the completed “Record Drawings”.

B. The Engineer shall furnish to the Contractor electronic files of the Contract Drawings in AutoCAD format for the Contractors’ use in preparing a final electronic copy of the record drawings which shall incorporate all of changes made including all project addenda. Drawing changes shall be identified as follows:
   1. The affected change shall be identified in an enclosed clouded area of a consistent color not used to indicate the noted change.
   2. Each cloud shall have an identifier adjacent to the cloud identifying the date and origin of the change. (i.e., 1-12-06, Construction Directive, 1-12-06, Change Proposal, 1-12-06, Field Coordination, etc.).

C. Submission of electronic Record Drawings shall be made on compact disk in AutoCAD format and accompany one (1) full size set of bond plots in color on white background. Plots shall be generated from the CD of electronic files. Electronic file names and plot sheet numbering shall match Contract Document format.

1.9 ACCESS DOORS & PANELS

A. Furnish an access door and panels for each pipe and duct chase for each floor, fire dampers, etc. Size as required for access, 16" X 16" minimum.

B. Also, provide access doors in all non-removable ceilings and in partitions and walls where necessary to maintain access to fire dampers, manual dampers, valves, shock arrestors, and other mechanical devices requiring access.

C. Any access door installed in fire rated surface or assembly shall carry a U.L. Listing and an approved fire rating for that construction type.

D. Provide access doors/panels as required to test and reset automatic fire dampers.

E. Provide all access doors to the General Contractor for the timely inclusion in the building construction.

F. Refer to architectural section “08311 – ACCESS DOORS AND FRAMES” for product’s construction and installation requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.2 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections “Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."
8.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

D. Provide factory start up on all major pieces of equipment, with letter of certification stating proper installation is present for the following components:

Boilers
Cooling tower & Heat exchanger
Water Source Heat Pump Units
Roof mounted A/C units
Condensing units
Air-handling Units
Fan-Coil Units
Range Hood
Kitchen Hood
Controls System
Energy Management System
Energy Recovery Units
Pumps
Fans

3.5 SHOP DRAWINGS

A. Submit shop drawings along with an electronic formatted submittal for approval prior to commencing work. Hard copy shop drawings shall be bound in a three ring binder and shall include an index page with each item listed and referenced to sections with tabs. Tabs shall be cross referenced to index page. All shop drawings shall be prepared and submitted as a single package. **NO SHOP DRAWINGS WILL BE CHECKED UNTIL ALL HAVE BEEN SUBMITTED.** (HVAC controls submittals and any items with exceptionally long lead times that may affect the project completion date, as determined by the Engineer may be submitted separately). **Electronic shop drawings shall be a single PDF file and formatted as required for hard copy submittals. Each section shall be a bookmarked (tabbed) link named to describe the section. (ELECTRONIC SHOP DRAWINGS NOT PROPERLY FORMATTED WILL BE RETURNED UNCHECKED.)**

B. The following format shall be followed:

1. The submittal cover sheet shall include-
   Project Name
   Type of Shop Drawing including trade (HVAC, Plumbing, Fire Protection)
   Mechanical Contractor's Company Name
   Date of Submittal

2. The first sheet inside the submittal shall include all items on the cover sheet plus the following:
   Owner
   Architect
   Engineer
   Mechanical Contractor's Project Manager's Name

3. The supervising license holder(s) shall be identified, and a copy of their current valid license shall be included.
4. The second sheet shall include the following typed statement, signed and dated by the mechanical contractor's project manager-

   "The enclosed submittal (shop drawings) has been reviewed for accuracy of equipment and system quality and component quantities. The available voltages have been coordinated with the electrical contractor. All coordination items with other trades have been completed including structural, electrical, and other mechanical division disciplines prior to ordering any equipment."

C. The Contractor shall review the information prepared by his suppliers and note any changes required prior to submitting the information to the Engineer and shall include the form (found at the end of this section), Exhibit 1, entitled "Certification of Compliance - Shop Drawings" with each submittal prior to the index page and submittal data sheets. Failure to complete and execute this form will result in rejection of the submittal without review.

D. Each individual submittal item shall be marked to show Specifications Section and Paragraph number which pertains to the item. Shop Drawings shall clearly indicate location, fixture no. or equipment designation, etc., so that the intended use of the equipment can be readily identified. Failure to make submittals accordingly shall be considered cause for rejection of shop drawings.

E. Submittals shall be supported by descriptive material, such as catalog cuts, diagrams, certified performance curves and charts published by the manufacturer to show conformance to

specification and drawing requirements, model numbers alone will not be acceptable. All literature shall clearly indicate the specified model number, options to be included, dimensions, arrangement, rating and characteristics of the proposed equipment. Capacities and ratings shall be based on conditions indicated or specified herein. Any deviations from specified equipment shall be clearly noted in red.

F. The Engineer will review the shop drawings for errors in the Contractor's interpretation of the design intent only. Corrections or comments made on shop drawings during review shall not relieve the Contractor from compliance with requirements of the contract documents, plans and specifications. Review of shop drawings shall not relieve the Contractor from the responsibility for conforming and correlating all quantities and dimensions, coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

G. Review of shop drawings shall not permit any deviations from the plans and specifications nor shall it permit changes to the plans and specifications by the Engineer. Changes to or deviations from the contract documents are subject to the provisions of the General Conditions of the contract. Any required changes will then be issued by the Architect and executed by both the Owner and Contractor.

H. Each individual submittal item shall be marked to show Specifications Section and paragraph number which pertains to the item. Shop Drawings shall clearly indicate location, fixture no. or equipment designation, etc., so that the intended use of the equipment can be readily identified. Shop drawings shall be submitted for each of the following items:

Fans
Air Distribution Devices
Roof Mounted Air Intake/Relief Hoods
Electric Heaters
Ductwork & Ductwork Construction
Duct Access Panels
Gas Flues
Air-handling Units
Manual Dampers
Pumps
Boilers
Chillers
Thermometers
Relief Valve
Hot Water Unit Heaters
Backflow Preventers
Plumbing Fixtures & Fittings
Valves & Unions
Shock Arrestors
Valve Schedules and Diagrams
Floor Drains
Sheet Lead Flashing
Pressure Reducing Valves
Pipe Accessories
Pipe Hangers, Supports & Accessories
Flexible Pipe Hose Kits w/ Valves & Fittings
Fire & Smoke Dampers
Automatic Dampers
Flexible Ductwork
Vibration Isolation Equipment
Roof Mounted A/C Units
Condensing Units
Roof Curbs
Automatic Flow Control Valves
Heat Exchangers
Centrifugal Sediment Separator
Pressure Gauges
Kiln Hood
Pipe Identification Systems
Manholes and Accessories
Water Heaters & Accessories
Cleanouts & Accessories
Access Covers & Panels
Wall Hydrants & NFWH's
Gauges
Energy Recovery Units
HVAC Pipe Accessories
Bi-Polar Ionization Units
Contractor Start up forms
Fan-coil Units

Kitchen Rangehood & Associated Fire Suppression System
Controls & Control Diagrams including Wiring Plans
Pipe & Duct Insulation & Accessories
Fire Protection: AHJ Approved Shop Drawings with Complete Hydraulic Analysis
Fire protection system valves and accessories
Supervisory switches & Flow switches
Precast concrete drainage structures and vaults
All equipment and systems training forms with a sign off blank
Underground piping systems

I. For miscellaneous items not listed here, contractor shall submit shop drawings for approval, unless the item is to be provided and installed **exactly** as specified, without variance.

J. Contractor shall provide a sign in sheet for each piece of equipment requiring Owner training noted in division 23. Training required for all equipment including the following: Water heaters, tempering valves, circulating pumps, HVAC pumps, electric heaters, boilers, cooling towers, water source heat pump units, condensing units, heat pump units, air handling unit, fan-coil units, rooftop units, split systems, energy recovery units, commercial kitchen hood, residential and commercial hood fire suppression systems and HVAC controls (controls shall include Reliable as well as any non- Reliable controls, i.e. wall mounted timers and wall mounted switches).

K. Submit evidence of welders' qualifications prior to performing any welds.

L. In addition, contractor shall prepare and submit dimensioned shop drawings (drawn at minimum 1/4"=1'-0" scale) of all ductwork, piping and equipment (HVAC) on the entire project. The drawings shall be created with computer aided drafting software. This shall also include actual mechanical room layouts, typical sections through corridors, pipe sleeves and other penetrations through slabs and walls for HVAC including fire and smoke walls. These shop drawings shall be submitted as PDF, along with a set of prints equal to the number of copies of submittals required by the Contract Documents.

M. COMMISSIONING

1. The contractor will obtain a commissioning agency to perform commissioning duties required to check that all devices work properly, as outlined in the contract documents, and as required by the equipment manufacturer's recommendations.

2. The contractor shall cooperate with the commissioning agency or sub-contractor and shall provide the following:
   a. Provide shop drawings of all equipment furnished.
   b. Start all equipment and provide all labor required to keep it in good working order during the test and balance procedure. Provide clean filters in each unit at the start of the procedure.
   c. Make all adjustments and corrections necessary to the equipment, air and water control devices, necessary to achieve the required HVAC system functions.

END OF SECTION 23 05 00 (Except for 2 forms below:)

SECTION 23 05 00 - Exhibit No. 1

CERTIFICATION OF COMPLIANCE - SHOP DRAWINGS

To:

Project:

I have reviewed the contract documents, including but not limited to specifications, drawings, addenda, and change orders. To the best of my knowledge the materials described by the enclosed shop drawings are consistent with and meet the requirements of the aforementioned documents. I further recognize that; 1) the engineers review is to assist me in complying with the documents by checking for errors in my interpretation of the requirements set forth in the contract documents, 2) review of shop drawings, by the engineer, shall not relieve me of my responsibility for confirming and correlating all quantities, dimensions and work with that of other trades, and for performing the work in a safe and satisfactory manner, and 3) review of shop drawings, by the engineer, shall not permit any deviations from plans and specifications.

I understand that I will be required to remove and replace at no additional cost to the owner any item found to be inconsistent with or not meet the requirements of the contract documents.

The undersigned states that the above is true to the best of his knowledge and that he has the authority to legally bind his firm to the above terms. Failure to provide a legally binding signature shall void submittal.

Sub Contractor:

By: _____ Date: _____

Ga. State License No (Required): _____

Title: _____

Company: _____

General Contractor:

By: _____ Date: _____

Title: _____

Company: _____

SECTION 2 05 00 - Exhibit No. 2

A/C Contractor shall make out start-up cards for all heat and cool units as per start up card furnished below and shall furnish same before substantial completion inspection for each phase of construction.

A/C CONTRACTOR'S START-UP CARD
Cy Nunnally Memorial Airport Terminal

School Name _____

HVAC Contractor _____

Unit #_____

Unit Model Number _____ Unit Serial Number _____

A/C EQUIPMENT

Rated Volts - _____
Rated Amps - _____

	COOLING	HEATING
Discharge Pressure	_____	_____
Suction Pressure	_____	_____
Return Air Temp.	_____	_____
Supply Air Temp.	_____	_____

ELECTRIC HEAT

Unit #_____	Actual Volts	Rated Volts	Rated Amps	Actual Amps
	_____	_____	_____	_____

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 and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.
1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

L. Manufacturers
1. Baldor
2. Marathon
3. U.S.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: All motors used with VFD drives shall be suitable for inverter duty usage and comply with the following:
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. Provide pre-installed Aegis SGR bearing protection rings (grounding rings) or equal on motor shaft for all motors with variable frequency drives. Ring shall be sized to protect motor bearings. Rings shall be maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

D. Manufacturers
1. Baldor
2. Marathon
3. U.S.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, 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.

2.6 STARTERS

A. Power controllers shall be provided for the equipment furnished under this specification. When not provided as a component of the equipment specified, external starters shall be provided under this division to control the equipment as outlined in the control specifications. Starters and contactors shall be constructed in accordance with the NEMA Standards. Starters shall have overload and running protection in each power phase.

B. Voltage for holding coils shall not exceed 120 volts, unless otherwise specified: provide built-in transformers with fuses. Provide auxiliary contacts as required by control circuits.

C. Starters shall be furnished with individual phase thermal overload protection, and with two (2) normally open auxiliary contacts, "Hand-Off-Auto" switch, 24 VAC coil, 24 VAC control transformer, and pilot light.

D. All external starters shall have NEMA-4 rated enclosures for weatherproof operation and stainless steel enclosure finish.

E. Motor starters shall be manufactured by ABB A-line, Furnas, Square D, Westinghouse, Siemens, and General Electric.

F. Each starter shall be provided engraved laminated plastic nameplates describing the piece of equipment being served.

2.7 VARIABLE SPEED DRIVES

A. Variable speed frequency drives shall be provided for the rooftop units blower fan. Coordinate horsepower requirements with equipment schedules. All drives shall be located in the main mechanical room.

B. Drives shall be specifically manufactured for HVAC application. The drives shall digitally control both voltage and frequency to standard induction motors.

C. Standard features include PID control, DC link reactor for harmonics control, and energy optimizing capabilities.

D. The entire package shall be factory engineered for low noise and high energy efficiency, and shall be factory assembled and tested, and carry the U.L. label.

E. Units shall be rated for and comply with the following minimum criteria:
1. Displacement factor: 0.98 or greater
2. Drive efficiency: 97% or greater
3. Inline voltage range for full load: Nominal 10% + or -
4. Adjustable maximum speed: to 120 Hz
5. Adjustable minimum speed: to 0 Hz
6. Adjustable acceleration time: to 3,600 seconds
7. Adjustable deceleration time: to 3,600 seconds
8. Maximum number of preset speeds:16
9. Maximum number of frequency stepovers:4
10. Maximum number of accel rates:4
11. Maximum number of decel rates:4
12. Number of programmable digital inputs:8
13. Number of programmable analog inputs: 3, 2 for voltage, 1 for current
14. Number of programmable analog outputs: 2
15. Number of relay outputs: (1) 50 VAC, 1 A standard, (1) Form C 240 VAC, 2 A standard, (4) additional
16. Relay ON delay and Relay OFF delay:0 to 600 seconds
17. Display Languages: 9

F. Standard features:
1. DC link reactor on both DC bus lines for control of harmonic distortion and line-coupled electrical noise
2. Built-in two setpoint PID controller
3. Built-in N2 communication
4. Built-in FLN communication

5. All parameters can be uploaded to keypad and downloaded to all drives
6. "Flying Start" synchronizes drive with a motor rotating in either direction
7. Auto ramping ensures no-trip acceleration and deceleration
8. Signal loss detection
9. Loss of load/broken belt detection
10. Safety interlock provides external fault indication
11. Sleep mode stops drive at predetermined operating condition and restarts drive at specified demand to maximize savings and reduce wear of the driven equipment
12. Constant torque start always available to provide easy starting of high inertia and high friction loads.

G. Variable speed drives shall contain automatic by-passes to allow operation of equipment on drive failure. Bypass shall include an adjustable time delay to automatically bypass after cycle has expired and drive has not started. Additional contacts to interlock with building management and control system shall be included, and shall indicate drive and line operation.

H. Unit shall be manufactured by ABB, Emerson, Yaskawa.

PART 3 - <u>EXECUTION (Not Applicable)</u>

END OF SECTION 23 05 13

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:
1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
3. Section 233113 Metal Ducts duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Metal framing systems.
   3. Pipe stands.
   4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of trapeze hangers.
   2. Design Calculations: Calculate requirements for designing trapeze hangers.

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: Pre-galvanized 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.

C. In addition to the above maximum spacing requirements, hangers and supports shall be installed within 18" of each change in direction, regardless of pipe size or material.

D. Provide all hangers and rods, turnbuckles, angles, channels and other structural supports to support the piping systems. Rods for pipe hangers shall be the following minimum sizes:

HANGER ROD DIAMETER	PIPE SIZE
3/8"	2" and smaller
1/2"	2-1/2" and 3"
5/8"	4" and 5"
3/4"	6"

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. B-Line, by Eaton, Thomas & Betts, Unistrut
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.
8. Paint Coating: Epoxy
9. Plastic Coating: Epoxy

B. Non-MFMA Manufacturer Metal Framing Systems:
1. B-Line, by Eaton, Thomas & Betts, Unistrut
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc

2.4 THERMAL-HANGER SHIELD INSERTS

A. Pipe Shields, Inc., PHS Industries, Piping Technology and Products.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:
   1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   2. Base: Plastic.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 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: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi , 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2″ and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 :12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 2”.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports 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 refrigerant piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. 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 12.
   2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 12, requiring clamp flexibility and up to 4 inches of insulation.
   3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

6. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
7. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
8. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. 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.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F typical piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use mechanical expansion anchors instead of building attachments where required in concrete construction.

3.7 HANGER AND SUPPORT INSTALLATION

A. SUSPENDED HORIZONTAL PIPING

1. Support Spacing:

NOMINAL PIPE SIZE	MATERIAL	MAXIMUM SPACING OF SUPPORTS / FT.
Up through 1-1/2"	Steel & Copper	6'-0"
2" through 8"	Steel & Copper	8'-0"

2. In addition to the above maximum spacing requirements, hangers and supports shall be installed within 18" of each change in direction, regardless of pipe size or material.
3. Provide all hangers and rods, turnbuckles, angles, channels and other structural supports to support the piping systems. Rods for pipe hangers shall be as follows:

HANGER ROD DIAMETER	PIPE SIZE
3/8"	2" and smaller
1/2"	2-1/2" and 3"
5/8"	4" and 5"
3/4"	6"

4. Intermediate pipe supports provided between building structural members so as not to exceed maximum support spacing specified from top chord of framing joist shall be structural steel angles (minimum 2-1/2" X 2-1/2" X 1/4").
5. All ferrous metal pipe hangers and supplemental steel shall be provided with factory applied coat of rust inhibitive paint, plating or galvanizing.
6. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit around the pipe, pipe insulation and pipe insulation protective shields.
   a. Condensate piping
   b. Refrigerant piping
7. All supporting equipment shall be designed with a minimum factor of safety of five based on the ultimate tensile strength of the materials employed.

B. Steel 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 building structure.

C. 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 above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fastener System Installation:
   1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:
   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 according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe:
   a. Provide galvanized sheet metal pipe insulation protection shields at each pipe hanger for all horizontal insulated water pipes and condensate drain pipes. Shield sizes shall be:
      1) Pipes 2" and smaller: 18 gauge X 12" long
      2) Pipes 2-1/2" and larger: 16 gauge X 18" long
   b. Shields shall be 180 degree type at all pipe hangers, except that on trapeze hangers, pipe rack and on floor supported horizontal pipe shields shall be 360 degree type. For pipe sizes 2-1/2" and larger, use Foamglass inserts at all shields, hangers, sleeves, etc.
5. Pipes NPS 2-1/2" and Larger: Include wood or foamglass inserts.
6. Insert Material: Length at least as long as protective shield.

END OF SECTION 230529

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Seton, Stranco, Inc, Craftmark Markers
2. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

3. Letter Color: Black
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2 inch
6. Minimum Letter Size: 1 inch, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Manufacturers: Bradmark, Seton, Brady, Mifab or approved equal are acceptable.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black
4. Background Color: [White
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2 inch.
7. Minimum Letter Size: 1” for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Seton, Stranco, Inc, Craftmark Markers

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 4 by 2 inch.

G. Minimum Letter Size: 1 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Seton, Brimar, Craftmark Markers

B. Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping at least 1 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances].

2.4 VALVE TAGS

A. Seton, Brimar, Craftmark Markers

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link chain

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Seton, Stranco, Inc, Craftmark Markers

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum
   2. Fasteners: Brass grommet and wire
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Safety-yellow background with black lettering.

2.6 STENCILS

A. Stencils for Ducts:
   1. Craftsmark, Carlton, Brimar.
   2. Lettering Size: Minimum letter height of 2 inches (32 mm) for viewing distances up to 15 feet (4-1/2 m) and proportionately larger lettering for greater viewing distances.
   3. Stencil Material: Fiberboard or metal.
   4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
   5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

B. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
   1. Craftsmark, Carlton, Brimar.
   2. Lettering Size: Minimum letter height of 2” for viewing distances up to 72 inches (1830 mm) and proportionately larger lettering for greater viewing distances.
   3. Stencil Material: Fiberboard or metal.
   4. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
   5. Identification Paint: Exterior, acrylic enamel. Paint may be in pressurized spray-can form.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

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.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE PAINTING AND LABEL INSTALLATION

A.

B. A.Piping Color Coding: Painting of piping is specified in Division 09 and as noted below.
   1. *1. All building loop pipe (Condenser-Water Piping) shall be painted with a 12” band on each side of a wall penetration, each side of a floor penetration and as the pipe enters and exits chases.
   2. Colors:
      a. Supply Piping: Safety-Green
      b. Return Piping: Safety-Orange

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations and on both sides of 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 30’ along each run. Reduce intervals to 20 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:
   1. Chilled-Water Piping: White letters on a safety-green background.
   2. Condenser-Water Piping: White letters on a safety-green background
   3. Heating Water Piping: White letters on a safety-green background
   4. Refrigerant Piping: Black letters on a safety-orange background

3.5 DUCT STENCIL INSTALLATION

A. Install duct stencils on air ducts in the following color codes:
   1. Blue: For cold-air supply ducts.

2. Yellow. For hot-air supply ducts.
3. Green. For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Stenciled Duct Labels: Stenciled labels shall show service and flow direction.

C. Locate stencils and connections to equipment and near points where ducts enter into and exit from concealed spaces, and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
   a. 2” round for all water, gas, and refrigerant valves.
   b.
2. Valve-Tag Colors:
   a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
   b. Flammable Fluids: Black letters on a safety-yellow background.
   c. Combustible Fluids: White letters on a safety-brown background.
   d. Potable and Other Water: White letters on a safety-green background.
   e. Compressed Air: White letters on a safety-blue background.
   f. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

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.

B. All work in this Section must comply with Section 23 0500 of these Specifications.

1.2 QUALIFICATIONS

A. An independent test and balance agency certified by the Associated Air Balance Council (AABC) that specializes in and whose business is limited solely to testing, adjusting and balancing air conditioning systems shall be retained and shall completely test and balance the HVAC system in complete accordance with Associated Air Balance Council Standards, latest edition, for total system balance. All work shall be performed under direct supervision of an AABC certified test and balance engineer.

1.3 QUALIFICATION SUBMITTALS

A. Testing and Balancing (TAB) Agency shall submit a company resume listing personnel and project experience in the field of air and hydronic system balancing. Submittal shall include an inventory of all instruments and devices used to test, adjust and balance systems and a working agenda which shall include procedures for testing and balancing each type of air and water system specified indicating all data to be recorded.

1.4 CONTRACT DOCUMENTS

A. Within 60 days of acceptance of contract, the TAB Agency shall obtain a complete set of Construction Documents, Equipment Specifications, and Equipment Submittals including all pertinent addenda items.

B. The TAB Agency shall be provided by the General Contractor or Mechanical Contractor the following items when issued or received:
1. Copies of all Addenda
2. Change Orders
3. Equipment Manufacturer’s Submittal Data
4. Mechanical Shop Drawings
5. Temperature Control Shop Drawings
6 Project Schedule

1.5 NOTIFICATION AND SCHEDULING

A. Before testing and balancing commences, the TAB Agency shall receive notification in writing from the Mechanical Contractor stating that the HVAC system(s) is operational, complete and ready for balancing. A complete system means more than just physical installation. The Me

chanical Contractor shall certify that all prime movers: fans, pumps, refrigerant machines, boilers, etc., are installed in good working order, and that full load performance has been preliminarily tested. Mechanical Contractor shall certify in writing that all equipment has been checked, started, adjusted and operated per the manufacturer's recommendations. Mechanical Contractor shall include copies of factory start-up reports for specified equipment.

B. The schedule for testing and balancing of the HVAC systems shall be established once notification has been received by the TAB Agency.

1.6 COORDINATION WITH OTHER TRADES

A. The owner or owner's representative, Mechanical Contractor, Temperature Control Subcontractor and the supplier of the HVAC equipment shall cooperate with the TAB Agency to provide all necessary data on design and proper application of the system components. In addition, they shall furnish all labor and materials required to eliminate any system deficiencies.

B. The TAB Agency shall coordinate the location and type of all taps, valves, sensors, damper, etc., as required for proper system testing and balancing with the Mechanical Contractor prior to beginning work.

C. The TAB Agency shall visit project before beginning initial testing and balancing to inspect installation of HVAC system, location and testing of all testing taps, etc., and provide a written report of all deficiencies to the Mechanical Contractor, Mechanical Engineer and Architect.

D. To bring the HVAC system(s) into a state of readiness for testing, adjusting and balancing, the installing Mechanical Contractor shall perform the following:
1. Activate all equipment in the cooling mode.
2. Activate all equipment in the heating mode
3. Run test all sequences of operation for controls and equipment.

1.7 AIR SYSTEMS

A. Ensure that all splitters, extractors, volume, smoke and fire dampers are properly located and functional. Dampers serving the requirements of smoke, outside air, return air and exhaust air shall provide tight closure and full opening, with smooth, free operation.

B. Verify that all supply, return, exhaust and transfer grilles, registers, diffusers are installed properly and free of objectionable noise.

C. Verify that all fans are operating and free of vibration. All fans and drives shall be checked for proper rotation and belt tension.

D. Install clean filters in all units prior to testing.

E. Make all necessary changes as required by the TAB Agency, at no additional charge to the owner.

F. Water Circulating System
1. Check all pumps for proper alignment and rotation.

2. Ensure that all water systems have been properly cleaned, strainers removed, cleaned, are full and free of air, that expansion tanks have been properly charged and that air vents have been installed in all high points in piping systems.

G. Temperature Control
1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, and fire and smoke dampers.
2. Verify that all sensors are calibrated and set for design operating conditions.
3. Make available to the TAB Agency any needed unique instruments for setting of D.D.C. controls.
4. Provide assistance and instruction to the TAB Agency in the proper use and settings of control components.

PART 2 - PRODUCTS

2.1 TESTING AND BALANCING INSTRUMENTS

A. Instruments used for testing and balancing must have been calibrated within a period of six (6) months prior to beginning testing and balancing of this project. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

PART 3 - EXECUTION

3.1 PRECONSTRUCTION PLAN CHECK AND REVIEW

A. The TAB Agency shall preform a preconstruction review of the contract documents and equipment submittals for their effect on the testing and balancing process. Review shall include location and type of volume dampers, air valves, balancing valves, flow metering stations, automatic control valves, pressure sensors, sheet metal and piping shop drawings.

B. Submit any recommendations for enhancements or changes to the system within 30 days of document review.

3.2 ON-GOING JOB SITE INSPECTIONS

A. During construction, the test and balance agency shall inspect the installation of pipe systems, sheet metal work, temperature controls and other component parts of the HVAC systems. Inspections shall be performed when 60% of the piping and or sheet work is installed and again when 90% of the total HVAC system is installed and prior to insulation of piping systems.

B. The balancing agency shall submit a written report of each inspection to the owner's representative, the Mechanical Engineer and the contractor responsible for correcting any noted deficiencies.

C. Inspections shall check for all necessary balancing hardware (dampers, flow meters, valves, pressure taps, thermometer wells, etc.) to determine if they are installed properly and readily accessible.

D. Identify and evaluate any variations from system design.

E. Identify and report possible restrictions in systems (closed dampers, long runs of flexible ductwork, poorly designed or connected duct fittings, excessive piping losses, etc.).

3.3 RECORD & REPORT DATA

A. The Test and Balance report shall be complete with logs, data and records as required herein. Air and water flow quantities shall be balanced within 5% of the values specified in the contract documents. All logs, data and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the Testing and Balancing Agency's registered Professional Engineer.

B. Six copies of the Certified Test and Balance Reports shall be submitted to the Architect for review and acceptance.

C. The report shall include, but not be limited to, the following data.
1. Project Number
2. Contract Number
3. Project Title
4. Project Location
5. Project Architect
6. Project Mechanical Engineer
7. General Contractor
8. Mechanical Contractor
9. Date tests were preformed
10. Certification
11. General discussion of system(s) and any abnormalities or problems encountered.
12. Test and Report Forms

	AABC Form No.
Cover Sheet	89010
Instrument List	89020
Air Moving Equipment Test Sheet	89030
Exhaust Fan Data Sheet	89031
Return/Outside Air Data	89033
Air Distribution Test Sheet	89040
Temperature Readings	89043
Electric Heater Report	89050
Cooling Coil Data	89101
Combustion Test	89600
Other Forms as Required	-----

D. The following items shall be tested, balanced, adjusted as required for proper system operation:
1. Adjust all diffusers, grilles and registers to minimize drafts in all areas
2. Outdoor Air Units
3. Wall Mounted Air-Conditioning Units
4. Supply and Return Air Grilles and Diffusers
5. Supply & Exhaust Fans
6. Unit Heaters
7. Electric Heaters
8. Split Systems

9. Rooftop Units
10. Air-Handling Units

E. Overall system(s) and installation for compliance with contract drawings and specifications.

3.4 CONTROL SYSTEM VERIFICATION

A. Verify that all control devices are properly connected

B. Verify that all dampers, valves and other controlled devices are operated by the intended controller.

C. Verify that all dampers and valves are in the position indicating by the controller (open, closed and modulating).

D. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions.

E. Check that all valves are properly installed in the piping system in relation to direction of flow and location.

F. Check the calibration of all controllers

G. Check the locations of all sensors to determine whether their position will allow them sense only the intended temperatures or pressures. Control contractor shall relocate as deemed necessary by the TAB Agency.

H. Check locations of all sensors, thermostats, etc., for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.

I. Verify the operation of all interlocked systems.

J. Verify that all controller set points meet the design intent.

K. Perform all system verification to assure the safety of the system and its components.

3.5 SYSTEM PERFORMANCE VERIFICATION

A. At the time of final inspection, the Test and Balance Contractor shall recheck, in the presence of the owner’s representative random selections of data, air and hydronic quantities and other items recorded in the Certified Report.

B. Points and areas for recheck will be selected by the Owner’s representative and shall not exceed 25 percent of the total number tabulated in the Certified Report.

C. If random tests indicate a measured deviation in air or hydronic flow of ten percent or more from that recorded in the Certified Report, the complete report is rejected, all systems shall be readjusted and tested, new data recorded, new Certified Reports prepared and submitted, and new inspection tests made, all at no additional cost to the owner.

D. Following system verification of the Certified Report by the Owner's Representative, the settings of all valves, splitter dampers, and other devices shall be permanently marked by the Test and Balance Agency, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after system verification.

3.6 OPPOSITE SEASON TEST

A. Testing and Balancing Agency shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The TAB Agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

B. The Contractor shall resubmit six (6) copies of the complete test and balance reports to the Engineer for approval prior to final acceptance of the project.

END OF SECTION 23 0593

SECTION 230700

HVAC 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 and piping services:
1. Indoor, concealed supply, return and outdoor air.
2. Indoor, exposed supply, return and outdoor air.
3. Indoor, Type I, commercial, kitchen hood exhaust.
4. Indoor, exhaust between isolation damper and penetration of building exterior.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.
7. Refrigerant piping
8. Indoor, Condensate piping

B. Related Sections:
1. Section 23 07 16 "HVAC Equipment Insulation."
2. Section 23 31 13 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data:

B. For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 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.

C. Field quality-control 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. 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.

C. Coordinate installation and testing of heat tracing.

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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
   1. Aeroflex, Armacell, K-Flex

F. 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. CertainTeed, Johns-Manville, Knauf, Owens Corning, and Manson

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket.
   1. CertainTeed, Johns-Manville, Knauf,, Owens Corning

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less.
   1.
   2. CertainTeed, Johns-Manville, Knauf,, Owens Corning

I. Calcium Silicate:
   1. Industrial Insulation or equal.
   2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
   4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

J. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Pittsburg Corning or equal
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   6. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
   7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

K. Mineral-Fiber, Preformed Pipe Insulation:
   1. Manson, Johns-Manville, Knauf,, Owens Corning
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.

L. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
   1. Duna, Dyplast, Elliott, ITW Insulation
   2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg Fat 75 deg F after 180 days of aging.
   3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch as tested by ASTM E 84.
   4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
   5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
      a. Pipe Applications: Vinyl or Aluminum Jacket

M. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
   1. Armacell, Nomaco, and K-Flex

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
   1. Johns Manville, CertainTeed, Thermal Ceramics

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Foster K-Flex, Aerocell, Armacell

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Foster, Childers, Eagle, Mon-Eco

2.

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. Foster, Childers, Eagle, Mon-Eco>

E. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. CertainTeed, Johns-Manville, Knauf,, Owens Corning_MASTICS

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic, Water based; suitable for indoor use on below ambient services.
   1. Foster, Knauf, Vimason
   2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mildry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
   1.
   2. Childers Brand, Eagle Bridges, Foster Brand
   3. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-midry film thickness.
   4. Service Temperature Range: Minus 50 to plus 220 deg F.
   5. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
   6. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
   1. Foster, Childers, Eagle, Mon-Eco
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 40 to plus 250 deg F.
   5. Color: Aluminum.
   6.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
   1. Foster, Childers, Eagle, Mon-Eco
   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.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
   4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
   5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Johns Manville, Proto, P.I.C. Plastics
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
   1. Childers, ITW Insulation Systems RPR Products
   2. Aluminum Jacket: Comply with ASTM B 209
      a. Factory cut and rolled to size
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier
      d. 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil thick polysurlyn.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
   1. Pittsburg Corning, Polyguard Products or approved equal

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Knauf, Ideal, Compac, Avery, Venture
   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.
   1. Knauf, Ideal, Compac, Avery, Venture
   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. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Knauf, Ideal, Compac, Venture
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   4. Adhesion: 64 ounces force/inch in width.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Knauf, Ideal, Compac, Avery, Venture
   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.

2.9 SECUREMENTS

A. Bands:
   1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal**.**

2.

B. Insulation Pins and Hangers for duct:
   1. Capacitor-Discharge-Weld Pins: Zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.
   2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
      a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
      b.

C. Duct Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Duct Wire: 0.062-inch soft-annealed, stainless steel. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain subparagraph and list of manufacturers below. See Section 016000 "Product 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.

3.3 GENERAL DUCT INSULATION INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Additional #18 gauge stainless steel wire on 4 foot centers, shall be installed for all ductwork with dimensions greater than 12" to prevent sagging. All punctures in vapor barrier shall be sealed. All joints shall be lapped and wired. Staples and tape alone for ductwork with dimensions greater than 12" will not be acceptable. Where service access is required, bevel and seal ends of insulation. For insulated ductwork exposed in mechanical rooms and located less than 8'-0" above finished floor, cover with 24 Ga. aluminum jacket.

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.

3.4 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, 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 shall be covered with a metal jacket.

3.5 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078413 "Penetration Firestopping."

E. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.6 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.

3.7 INSTALLATION OF MINERAL-FIBER DUCT INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive, tape, staples and wire wrap.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces with sides or bottoms greater than 36”.
   2. Apply adhesive to entire circumference of all duct joints and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. Additional #18 gauge stainless steel wire on 4 foot centers, shall be installed for all ductwork with dimensions greater than 12" to prevent sagging. All punctures in vapor barrier shall be sealed. All joints shall be lapped and wired. Staples and tape alone for ductwork with dimensions greater than 12" will not be acceptable. Where service access is required, bevel and seal ends of insulation.
      b. Do not over compress insulation during installation.
      c. Impale insulation over pins and attach speed washers.
      d. 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.
      e. For insulated ductwork exposed in mechanical rooms and located less than 8'-0" above finished floor, cover with 24 Ga. aluminum jacket.
   4. For ducts and plenums install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

5. 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.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   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.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return.
   4. Indoor, exposed return.
   5. All duct associated with energy recovery unit including exhaust ductwork.

B. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   3. Factory-insulated flexible ducts.
   4. Factory-insulated plenums and casings.
   5. Flexible connectors.
   6. Vibration-control devices.
   7. Factory-insulated access panels and doors.
   8. Exhaust fan ductwork

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. All return air, outdoor air intake, supply air, ERU supply, ERU return and any ducts with an internal temperature below 65 degrees F shall be insulated with mineral-fiber blanket: 2" thick and 0.75 lb/ft3 nominal density.

3.13 PIPING INSULATION

A. All HVAC piping, other than heat pump loop piping, shall be insulated with minimum ½" thickness fiberglass or flexible Elastomeric insulation unless noted otherwise below.

B. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1/2 inch thick.
      b. Polyolefin: 1/2 inch thick.

C. External Tower Water:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Closed Cellular Glass: Unfaced preformed, rigid closed cellular glass material intended for use as thermal insulation Insulation, Type I: 1-1/2 inch thick, with minimum 0.016 aluminum jacket – electric heat tracing beneath.

D. Interior Tower Water:
   1. NPS 12 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I, 1-1/2 inches thick for piping up to 1-1/2", 2 inches thick, for piping 2" and greater.

E. Heating-Hot-Water (Boiler) Supply and Return, 200 Deg F and below:
   1. NPS 12 and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I, 1-1/2 inches thick for piping up to 1-1/2", 2 inches thick, for piping 2" and greater.

F. Refrigerant Suction and Hot-Gas Tubing:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Polyolefin: 1 inch thick.

3.14 INDOOR PIPING, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed and exposed:
   1. PVC 20 mils thick.

3.15 OUTDOOR PIPING, FIELD-APPLIED JACKET SCHEDULE, ABOVE GROUND

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket. Applies to refrigerant piping.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed and exposed:
   1. Aluminum, Smooth 0.040 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 23 07 00

SECTION 23 0800

MECHANICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Description of Work
2. Definitions
3. General
4. Commissioning and Start-Up
5. CxA Activities
6. CxA Schedule of Activities
7. Contractor Responsibilities

1.2 DESCRIPTION OF WORK

A. This Section includes work related to start-up procedures and the commissioning procedures related to systems installation and start-up. This section also includes a description of the duties of the Commissioning Agent (CxA) and contractor as they relate to start-up as well as other phases of the HVAC, fire protection and electrical work.

B. The activities called for in this Section apply to:
1. HVAC work called for by Division 23.

C. Refer to other Division 23 Sections of the Specifications for start-up procedures for any other building systems included in this scope.

D. The CxA shall be contracted by the mechanical contractor for all of the duties and responsibilities required herein.

E. The Contractor shall include the commissioning activities in the master construction schedule of work.

1.3 DEFINITIONS

A. APS Design Guidelines: A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, commissioning, training, documentation, and supporting information.

B. Basis of Design (BOD): A document that records concepts, calculations, system selection decisions, and product selections used to meet the APS Design Guidelines and to satisfy

applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

C. Commissioning: The systematic process of assuring by verification and documentation, from the design phase through occupancy that all facilities perform interactively in accordance with the design documentation and intent, and in accordance with the owner's operational needs, including preparation of operational personnel.

D. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. This is an overall plan that provides the structure, schedule, and coordination planning for commissioning. As construction progresses, the CxA will update the plan, which includes details of:
1. Commissioning scope.
2. Systems to be commissioned.
3. Rigor of commissioning.
4. Team contact information.
5. Roles and responsibilities of all parties.
6. Communication and reporting protocols.
7. Commissioning overview and details of submittal activities.
8. Construction observation, checklists, and start-up activities.
9. Process for dealing with deficiencies.
10. Test procedure development and execution.
11. Description of summary report, progress and reporting logs.

E. CxA: Commissioning Authority. The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The CxA has been engaged under a separate contract.

F. Construction Start-up: The initial activation or energizing of equipment or systems for the purpose of demonstrating completeness of installation, utility connections, performance, system operations, and ability to perform for its specified purpose.

G. Functional Performance Test (FPT) Procedures: This written protocol defines methods, personnel, and expectations for test conducted on components, equipment, assemblies, systems, and interfaces among systems. Tests clearly described the test prerequisites, required test conditions, individual systematic test procedures, expected system response and acceptance criteria for each procedure, actual response or findings, and any pertinent discussion. Test procedures differ from testing requirements found in the specifications, which describe what modes and features are to be tested and verified and under what conditions. Test procedures describe the step-by-step method of how to test. Simple checklists may be appropriate for testing simple components, but dynamic testing of interfacing components requires more detailed procedures and forms.

H. HVAC: The Heating, Ventilating and Air Conditioning system called for by the Contract Documents.

I. Issues Log: The purpose of this log is to provide a method for tracking and resolution of deficiencies discovered as a result of the commissioning process. This list also includes the current disposition of issues and the date of final resolution as confirmed by the Commissioning Authority. Deficiencies are defined as those issues where products, execution or performance do

not satisfy the Specifications and/or the design intent. The Issues Log will be created and managed by the commissioning Authority.

J. Pre-functional Checklists: Pre-functional checklists are forms developed by the contractor, equipment manufacturer, or CxA as applicable and used by the contractor to verify that specified systems and components are complete and correctly installed, ready for start-up and functional testing. These Checklists are supplemental to the equipment manufacturer's standard installation instructions and pre-start up forms. The Completed Checklists along with the equipment manufacturer's pre-start-up forms must be submitted by the contractor PRIOR to startup of the equipment. Equipment specified to have factory start-up performed must have the applicable Checklist filled out by the vendor and submitted by the contractor. After the Checklists have been approved and start-up has occurred, the contractor can begin their pre-checkout of the functional operations of the equipment and systems prior to validation by the CxA during the Functional Testing.

K. Pre-functional Testing: The process of starting the equipment and systems utilizing vendor/contractor startup and installation pre-functional checklists in coordination with the CxA's pre-functional documentation to ensure systems are operating in compliance with the contract documents, specifications and building automation system sequences, prior to functional validation by the CxA

L. Start Up: The initial activation or energizing of equipment or systems for the purpose of demonstrating completeness of installation, utility connections, performance, system operations, and ability to perform for its specified purpose.

M. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

PART 2 - PART 2 – PRODUCTS (Not Applicable)

PART 3 - PART 3 – EXECUTION

3.1 GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 23 specifications including specific contractor furnished items indicated by this Section shall be provided by the Contractor.

B. The Contractor shall provide all necessary manpower to assist the CxA in activities to access all equipment and components including providing ladders with personnel to remove and re-install ceiling tiles under equipment to be commissioned and providing door keys to access rooms throughout the buildings

C. Contractor shall perform the following
1. Contractor "in-house" preliminary commissioning and start-up based on equipment manufacturer's submitted procedures and the pre-functional CxA document to the CxA for review to assure the systems, equipment, and components are ready to be commissioned and inform the CxA that the commissioning start-up activities can begin.

2. The Contractor shall perform detailed "point to point" controls system check outs to verify that all DDC and life safety system wiring and any associated hard-wired interlocks are correct PRIOR to the commissioning acceptance testing activities by the CxA. Upon this completion by the Contractor, the Contractor shall work through the Controls Sequence of Operation with the CxA to verify that it meets the intent of the specifications. If sequences are found to require minor modifications based on actual field conditions, the Contractor and CxA shall jointly prepare recommendations and submit to the Owner and Engineer of Record for his approval of the modifications.
3. The contractor shall perform a pre-functional checkout of the building automation system to verify functional sequences are complete prior to commencing the functional systems validation by the CxA. After completion of the pre-functional checkout, demonstrate to the CxA that the systems operate as specified and complete. If the sequences are found to require minor modifications, based on actual field conditions, the contractor and CxA shall jointly prepare recommendations and submit to the Owner/Engineer of Record for approval, prior to modifications.

3.2 COMMISSIONING and START-UP

A. Place each item of equipment and each system into full operation.

B. Prior to start-Up:
1. The Commissioning Agent (CxA) shall verify that equipment and systems are complete, correctly connected to utilities, and tested. The CxA will submit to the Contractor and Architect/Engineer Commissioning Site Reports indicating any deficiencies in the installation relating to equipment and component connections (controls, piping, ductwork, etc.), insulation installation, maintenance clearances for servicing components and removal/replacement of equipment, code required clearances, hanger suspension of equipment and components, etc. A detailed "Deficiency Log and Resolution Report" will be maintained throughout the construction process and updated on a timely basis for the team. The contractor shall respond to the CxA for each Deficiency Log within two (2) days of receipt with comments indicating scheduled completion dates and actual date of the completed work.
2. The CxA will witness a sample of the Contractor's flushing and cleaning of piping systems, and calibration of the automatic temperature controls. A Testing Record Log will be maintained though the construction process by the Contractor and submitted to the CxA for review.
3. Comply with requirements of manufacturers.
4. Perform all pre-start inspections and tests as called for in Division 23 including all equipment and as may be necessary to ensure that work is installed as specified and to determine suitability for energizing.
5. The Contractor shall provide power for start-up and testing as may be required by the CxA.
6. The Contractor shall arrange for a change over from temporary to permanent utility sources.
7. The Contractor shall re-adjust and lubricate operating components to ensure smooth and unhindered operation.
    a. The Contractor shall check drive rotations, belt tension, control sequences, and other features which might cause damage if not adjusted. The CxA shall re-confirm drive rotations.

8. When specified or when required by manufacturer, have manufacturer's representative perform start-up and supervise their activities.

C. Notify the CxA / Architect / Engineer a minimum of three (3) days prior to start-up of each item and system.

D. The CxA's witnessing of start-up and testing of major system equipment and components specified herein and in Division 23, shall take place with the assistance of the Contractor as required.

E. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
1. The CxA shall review the equipment manufacturer's pre-functional checklist for completion. The CxA may add to this checklist any requirements that go beyond the startup and installation checklists, which must be acknowledged before demonstration of the functional tests occur.
2. When specified or when required by manufacturer, have manufacturer's representative perform start-up witnessed by the CxA.
3. Review the manufacturer's representative written report of start-up operation and include in the Commissioning Report.

F. After start-up, the CxA shall notify the Contractor of any deficiency items requiring correction such as adjustments to components and equipment, any systems operation, equipment clearances for maintenance and code compliance, connections for: piping, power, ductwork, controls, etc.

G. The CxA shall perform with the Contractor assistance and manpower support component and system testing checking through every function and control sequence/cycle to ensure that it operates as designed and specified by conducting field observations for verification of the status of operation.

H. The CxA shall confirm the operation of equipment and systems documenting the results in the Commissioning Report and submit this to the Owner/Architect/Engineer for review.
1. The Contractor shall have the final version of the Operating and Maintenance manuals specified in Division 23 available during testing and demonstration for components and systems.

3.3 CxA ACTIVITIES

A. Assist the Architect / Engineer in verifying and documenting compliance with the contract documents.

B. Oversee the performance of the start-up and functional tests of equipment, systems and components working with the Contractor for the controls' sequences of operation.

C. Observe installed HVAC ductwork, piping systems, controls, and equipment prior to covering or ceiling and partition installation.

D. Make periodic site visits during equipment and system "rough-in" to review their installation with particular attention paid to proper access for maintenance, code required clearances,

equipment testing, balancing, replacement, etc. Document these findings in Commissioning Site Reports and Deficiency and Resolution Log Reports as "punch-list" items requiring correction by the Contractor.

E. Coordinate with the Contractor's construction schedule for implementation of the Commissioning Activities after reviewing the overall general construction schedule. Coordinate updates to the Commissioning Activities with the Contractor throughout the construction of the project.

F. Witness all design and performance tests called for by Division 23. Initiate and witness additional system and equipment tests as required to verify compliance and performance.

G. Monitor the installation of all major HVAC equipment and plumbing (water heating equipment only)

H. Attend site observations for substantial and final completion and assist in listing (punch list) the incomplete or corrective work called for.

I. Review all changes in scope that affect the systems to be installed related to the work of Division 23 and adjust the Commissioning Plan as required.

J. Field verify accuracy and completeness of the Test and Balance reports submitted under Division 23 by witnessing critical system balancing by the Test and Balance agent. Review the Test and Balance Report prior to project turnover to the Owner and forward comments to the Architect/Engineer and Owner.

K. Review the Contractor's installed piping and equipment identification and labeling for conformance to the specifications.

L. Coordinate the start-up with the Owner so that their staff can be present during the commissioning start-up and system testing activities.

M. Prepare and submit the Commissioning Report prior to project acceptance by the Owner. The report shall contain the Commissioning Plan consisting of the following:
1. Equipment and systems testing procedures
2. Commissioning Site Reports of punch list items
3. Completed Equipment Pre-functional Checklist Forms
4. Manufacturer Start-up Reports
5. Deficiency and Resolution Log reports
6. Testing Log reports

3.4 CxA - SCHEDULE OF ACTIVITIES

A. Within a timely fashion after the Notice to proceed, the CxA shall submit to the Contractor a schedule of the construction activities related to the work of Division 23, as called for by the Contract Documents, which the CxA will be inspecting, monitoring or performing, including the name of the person who will be performing the Activities. Periodic updates will be submitted during the course of the project to keep the Contractor current with any modifications to Contractor's construction schedule and the Schedule of Activities.

B. Prior to the beginning of any HVAC and plumbing systems field work, the CxA will forward to the Owner / Architect / Engineer and the Contractor copies of the applicable Pre-functional Checklist forms to be executed by the CxA with the assistance of the Contractor's field personnel.

C. The CxA shall prepare and distribute functional test procedures for completion by the CxA. These documents will be used during completion of the Functional Performance tests and during the CxA validation process to confirm systems are complete and operational.

3.5 CONTRACTOR RESPONSIBILITIES - CxA ACTVITIES

A. Contractor shall accommodate the duties and tasks of the CxA, including, but not limited to, by:
1. Allowing the CxA access to the site during normal working hours.
2. Working with the CxA to coordinate commissioning activities with construction activities and include these activities in the master construction schedule. This master construction schedule shall include a minimum of two (2) weeks of schedule time for the commissioning activities PRIOR to project turnover to the Owner for "final" building systems acceptance.
3. Making allowance in the overall project schedule for the integration of those commissioning activities which are dependent upon the activities and progress of the project. Allow a minimum of five (5) days from the start-up of the last unit in the system until the completion of the Commissioning process. Notify the CxA directly with a copy to the Architect, of any procedure, test, covering, installation, or start-up of equipment, which are on the Schedule of Activities.
4. Contractor shall inform the CxA of the schedule of his performance for Test and Balancing of the air systems, including flushing and cleaning of domestic hot water piping systems, and calibration of the automatic temperature controls.
5. The Controls contractor shall perform their own "Point-to-point" wiring and communications detailed field testing to assure all Controls systems are functioning properly PRIOR to the CxA's HVAC Functional Performance Testing activities. The Controls contractor shall assist the CxA in the field providing labor as required to operate the Control system computer software and hardware components during the Functional Performance Testing of all HVAC and plumbing (hot water system only) equipment, components and systems.
6. The Contractor shall respond in writing within seven (7) days of receipt to the Commissioning Site Reports and Deficiency and Resolution Log Reports with dates of completion of the associated punch list items noted by the CxA.
7. The Contractor shall provide power and fuel for start-up and testing as may be required by the CxA and other sections of the specifications.
8. The Contractor shall arrange for a change over from temporary to permanent utility sources.
9. The Contractor shall re-adjust and lubricate operating components to ensure smooth and unhindered operation.
10. The Contractor shall check drive rotations, belt tension, control sequences, and other features which might cause damage if not adjusted.
11. Where specified or when required by manufacturer, the Contractor shall have the manufacturer's representative perform start-up to be supervised by the CxA for their activities.

12. Trend logs required in the testing requirements will be set up and executed by the Contractor and provided to and analyzed by the CxA. Monitoring using data loggers will be conducted by the CxA as needed. Trend logs shall be compiled and transmitted to the CxA in a CSV or Excel format. PDF's and graphs are not acceptable. Trend logs and monitoring are conducted after manual testing and subsequent trouble-shooting are complete and systems are in normal operation without frequent service shutdowns, etc.

B. The contractor's schedule shall be the basis for the coordination of the CxA's activities. Input from the CxA shall not be used or construed to dictate the progress, timing or planning of any of the Contractor's work activities except as necessary to coordinate the CxA's scheduled activities.

C. Contractor shall provide a minimum of five (5) days written notice in advance of any test, cover-up, installation, or scheduled commissioning activity. Failure to provide this notice may result in the Contractor uncovering, re-testing or re-starting these systems at the Contractor's expense.

D. The Contractor shall, at all times and upon demand, make available to the CxA for inspection, the Record Drawings maintained in the field called for by the General Conditions, all currently approved Shop Drawings, and the current version of the Operation and Maintenance manuals.

E. The Contractor shall coordinate and make arrangements for a collaborative effort between the CxA and the HVAC subcontractor's Automatic Temperature Controls sub-subcontractor to perform functional performance tests on each item, sub-system and entire control system witnessed by the CxA. Additional systems as noted herein will require the Contractor's assistance in field personnel along with providing access to ceiling plenums and rooms (providing labor to remove/reinstall ceiling tiles, ladders, etc.).

F. The Contractor shall schedule the Work taking into account the activities to be performed by the CxA. No claim for delay or request for an extension of Contract Time will be allowed as the result of the scheduled activities of the CxA.

G. The Contractor shall take into account the activities of the CxA in submitting their Bid for the Work. No additional compensation or changes in the Contract Sum will be approved if the basis of the proposed change is a result of the prescribed activities of the CxA.

END OF SECTION 23 08 00

SECTION 23 0900

HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 OVERVIEW

A. This section covers labor, services, apparatus, wiring, piping and materials for and incidental to the installation of a system of automatic and manual controls.

B. All control, interlock and starting circuit wiring, except where otherwise specified or noted on the drawings, shall be furnished under this Section.

C. Starters and contactors shall be provided for motors and electric loads where these devices are not provided as part of the equipment served.

1.2 QUALITY ASSURANCE

A. Control installation work shall be performed by mechanics regularly employed in the installation of control systems. Control devices shall be Honeywell, Johnson Controls, Robertshaw, or Barber Coleman. All control devices shall be by one manufacturer.

1.3 SHOP DRAWINGS

A. Submittals shall include a proposed wiring diagram with accompanying complete typewritten sequence of operations. A symbols list defining all abbreviated components shall be included. A cut sheet on each component used in the system shall be included.

B. A copy of record control diagrams shall be framed under glass and mounted in the mechanical room. An extra copy of each shall be included in each operational and maintenance manual.

1.4 GUARANTEE

A. Upon completion of the installation and before final inspection, the Contractor shall regulate and adjust all control devices and equipment provided under this contract and shall place them in complete operating condition subject to the approval of the Architect/Engineer.

B. The Contractor shall, after completion of the original installation, provide any service incidental to the proper performance of the building control system for a period of one year from date of beneficial occupancy.

1.5 WIRING

A. Provide all wiring between fans, heaters, thermostats, roof top units, etc., and all equipment as necessary to achieve the specified sequence of operation.

B. All wiring required for building control system, including electrical interlock wiring, shall be provided by the Contractor. Detailed control wiring diagrams and necessary supervision shall be provided by the Contractor. The term "wiring" shall include wire,

conduit, miscellaneous material and labor required for mounting and wiring electrical and electronic control devices.

1.6 SYSTEM ACCEPTANCE

A. The system installation shall be complete in all respects and tested for proper operation prior to acceptance testing by the Owner's representative. A letter shall be submitted to the Engineer requesting system acceptance testing. This letter shall certify that all controls are installed and have been completely exercised for proper operation. When the system has been deemed satisfactory in whole by the Owner's representative, the system shall be accepted for beneficial use which shall start the warranty period.

1.7 LABELS

A. All controls shall be labeled with plastic labels corresponding to the control drawing designation. Labels shall be engraved plastic at individual controls and panels. Room thermostat shall be embossed plastic inside the cover.

1.8 MAINTENANCE MANUALS AND INSTRUCTIONS

A. Provide operating and maintenance manuals as specified in Section 15010 and include final corrected copies of control diagrams that include all changes made prior to completion of the installation. Post a copy of the final corrected control diagrams laminated in plastic in the mechanical equipment room.

B. Furnish a minimum of 2 hours on-site instruction for the Owner's operators and maintenance personnel. Training shall be provided during normal working hours.

C. Training shall include system wiring and operation, unit mounted controls locations and service emergency fixtures, alarms, re-set, service requirements, etc., as required to properly instruct Owner's personnel.

1.9 WORK BY OTHERS

A. The Contractor shall coordinate with work by other trades prior to installation of control system.

B. The sheet metal contractor shall verify required control damper quantities and sizes before dampers are ordered. Sheet metal contractor shall receive dampers at the job site, set dampers in place and shall provide access doors for dampers. The damper shaft shall be extended at a location that provides space for the actuator.

PART 2 - PRODUCTS

2.1 GENERAL

A. All controls shall be electric/electronic. All controls shall be fully modulating unless otherwise specified. All controls shall be fully adjustable to meet job conditions.

2.2 THERMOSTATS (PROGRAMMABLE)

A. Thermostat Manufacturers:
   1. Basis of design: Honeywell model Wi-Fi VisionPro 8000.
   2. Equals: Carrier and Trane

B. Thermostats serving rooftop units shall be multi-stage (as required by equipment served), automatic changeover type.
   1. Thermostats shall include minimum 10-hour battery back-up and manual override of two hours.
   2. Thermostats shall include available system settings of COOLING-HEATING-DEHUMIFICATION-AUTOMATIC-OFF and available fan settings of ON-AUTOMATIC-OFF.
   3. Thermostat shall be provided with a dehumidification setting range of 40%-60%RH.
   4. Humidity display range shall be 0%-99%RH
   5. Thermostat sensor accuracy shall +/- 1.5F at 70F.
   6. Thermostat shall be accessible remotely via smartphone, tablet or computer.
   7. Thermostat shall be equipped with a touchscreen display with a 2-line message center.
   8. Thermostat shall communicate with smartphones, tablets by Wi-Fi. Wi-Fi connections shall be via 802.11 b/g/n routers.

C. Thermostats serving fans or heaters shall be designed for the service required – heating only or cooling only.

D. All thermostats shall be provided with lockable covers, Kendall TG-1 or approved equal. Submit item for engineer and owner review.

2.3 TIMERS

A. Timers shall be M. H. Rhodes Model 93000 series or equal, 2-hour timers without hold feature.

2.4 MISCELLANEOUS

A. Miscellaneous controls and accessories such as relays, switches, etc., required for the complete control system shall be heavy duty type suitable for the service and shall be standard products of the control manufacturer.

2.5 MOTOR STARTERS AND CONTACTORS

A. Furnish individual automatic motor starters for all single or three phase motors.

B. Starters shall be furnished with individual phase thermal overload protection, and with two (2) normally open auxiliary contacts, "Hand-Off-Auto" switch, 24 VAC coil, 24 VAC control transformer, and pilot light.

C. Single phase fractional horsepower motors shall have internal thermal overload protection.

D. Interior mounted starters shall be mounted in individual Nema-1 enclosures.

E. Motor starters shall be General Electric or approved equal by Square-D, Westinghouse, Allen-Bradley, Furnas or Joslyn Clark.

F. Voltage for holding coils shall not exceed 120 volts. Provide built-in transformers with fuses. Provide auxiliary contacts as required by control circuits.

G. Each starter shall be provided engraved laminated plastic nameplates describing the piece of equipment being served.

2.6 WIRING AND CONDUIT

A. Wiring shall be run in conduit with outlet boxes and fittings equal to those specified under Division 26. Line voltage wiring shall be no smaller than 14-gauge, 600-volt wire.

B. Wiring shall be concealed in all finished areas.

2.7 CONTROL TRANSFORMERS

A. Provide and locate on the wall under the control panel, the control transformer, 120 VAC/24 VAC, 250 VA. Provide surge suppressor protection on the primary, and circuit breaker located inside the zone control panel, for the secondary. The primary shall be powered from a dedicated 20-amp circuit breaker in the electrical panel and labeled as temperature controls, coordinate with electrical contractor.

2.8 SAFETY THERMOSTATS

A. Fire protection thermostats shall be manual reset type (per NFPA 90A) or shall require some manual operation (As pushing a "Start" button on a motor starter) to restart fan operations.

2.9 EQUIPMENT SAFETY CONTROLS

A. Manufacturers of A/C units, heaters, fans, etc., shall be responsible for providing operation and safety controls mounted and wired complete from factory.

2.10 CONTROL PANELS

A. Control panels shall be dust tight and furnished with hinged locking doors. Provide an engraved nameplate on the face of the panel clearly describing its function, all devices inside shall be clearly labeled. All wiring within the panel shall be in accordance with NEMA, UL, NEC and local codes.

B. All relays, transducers, area controllers, local controllers, etc., shall be mounted within control panels.

2.11 RELAYS

A. All relays shall be plugged in, interchangeable, mounted on circuit board and wired to numbered terminal strips.

B. Start/Stop relays shall provide either momentary or maintained switching action appropriate for the motor being controlled.

2.12 PANEL WIRING

A. All wiring in the control panel shall be 24VAC and shall be run in track with cover. All wire shall be 600V insulated, #16 THHN, and each wire shall be individually numbered. Wire color shall be blue for all 24VAC "HOT", and yellow for all 24VAC "COMMON". Exception: The blue and yellow wire from the transformer secondary shall be #12, 600V.

2.13 SMOKE DETECTORS

A. Smoke detectors approved for duct installation shall be provided by Division 26 for all air systems of 2000 cfm capacity or above or as indicated on the drawings, to automatically shut down the supply fan and close all smoke dampers (as required). Each detector shall have an integral relay and be capable of operating a remote. All wiring shall be in conduit.

B. Smoke detectors shall be furnished by Division 26 and installed under Division 23. All wiring between detector and fire alarm system shall be provided and installed under Division 26. All wiring between detector and unit and between detector and unit served shall be provided and installed under Division 23. All wiring shall be in conduit.

2.14 DAMPER ACTUATORS

A. Damper actuators shall be 120 volt or 24-volt proportional motor operators. Any transformers and/or wiring required to utilize available power shall be provided by this contractor.

PART 3 - EXECUTION

3.1 DEVICE LOCATIONS

A. Unless otherwise noted, install room thermostats, instruments, and panels 4'-0" above floor.

B. Room thermostats shall be located where shown on floor plans. Coordinate location and conduit runs with the electrical contractor. Coordinate thermostat location so as not to interfere with casework, etc.

3.2 IDENTIFICATION

A. Controls, switches, night thermostats, starters, contactors and related devices shall be identified with engraved laminated plastic nameplates. Plate shall show function, system and control device identification number as indicated on the control drawing.

3.3 CONTROL WIRING

A. All control wiring shall be run in metal conduit with outlet boxes and fitting equal to those specified under Division 26. Line voltage wiring shall be no smaller than 14-gauge, 600-volt wire. All conduit shall be located in wall cavity or above ceilings. Wall surface mounted conduit shall be prohibited. Plenum rated cable routed exposed shall be prohibited. All wiring below grade shall be conduit.

B. Install control, pilot circuit and interlock wiring including wiring through interposed safety or auxiliary control devices required for operation of the equipment. All wiring in wall cavities and exposed in mechanical or electrical rooms or above the roof shall be run in conduit. At roof penetrations, wiring shall be run in conduit - conduit penetrations shall be thru roof curbs. All wiring routed in ceiling spaces may be run without conduit but shall be fastened to structural components at a maximum of 6'-0" o.c. Control and/or interlock wiring shall not be run in conduit with any power wiring other than that serving the equipment controlled.

C. Electrical wiring shall conform in all respects with the provisions of the National Electrical Code and the Electrical work specifications of Division 26.

D. Wires shall be identified at both ends with numbered labels to correspond to conductor numbers on the control diagrams.

E. Control voltage shall be a maximum of 24V, unless otherwise indicated, specified or required.

F. Wiring connections to terminal posts shall be made by means of compression type lugs. Wire splices shall be made with scotch locks.

G. Provide a separate numbered terminal connection for each wire entering panel.

H. Safety devices in motor control circuits shall be wired to interrupt the holding coil circuit, regardless of the position of any selector switches in the circuit.

I. Control circuit conductors shall be sized for a minimum voltage drop between the supply device and the farthest controlled device. Minimum wire size shall be No. 16.

3.4 FIRE ALARM INTERLOCK, EQUIPMENT INTERLOCK AND EMERGENCY

A. Provide relays and interlock wiring in the starting circuits of all air moving equipment to stop operation when the building fire alarm system is activated. Contacts shall be installed in the central fire alarm panel for this signal; coordinate with fire alarm panel furnished under Division 26.

B. Interlock, relays, etc., shall meet the expressed requirements of NFPA Code 90A.

C. Provide on the wall of the Elect. Room an "Emergency Stop" switch. Switch shall be labeled “Emergency Fan Shutdown Switch” and be located adjacent to room thermostat. Switch shall be wired so that all air moving equipment will immediately shut down when switch is depressed.

D. Provide all interlock wiring between air-conditioning units, fans, thermostats, and other related equipment as necessary to achieve the specified operating sequence.

3.5 SYSTEM CONFIGURATION

A. Individual thermostats in each space shall energize the respective HVAC units. The evaporator fan shall run continuously during occupied hours and cycle thru the night setback/setup thermostat setting during nighttime hours. Heating and cooling shall be thermostatically controlled (set 75 degrees F. cooling, 70 degrees F. heating, adjustable).

B. The thermostats' night setback shall be set to 65 degrees F heating, night set-up shall be set 80 degrees F cooling and night setback shall be set to 60%RH dehumidification. All settings shall be adjustable.

C. Coordinate owner occupied and unoccupied hours for system configuration.

D. Exhaust fan controls shall be per fan schedule notes.

E. Heaters shall be controlled by integral thermostats.

PART 4 - SEQUENCE OF OPERATION

4.1 SPLIT SYSTEMS

A. Thermostat shall be provided for each split system unit to control the fan, compressor, reverse cycle heat and electric heat in the unit.

Start/Stop
Cool 1 / Cool 2 or more if unit is capable – refer to equipment submittal
Heat 1 / Heat 2 or more if unit is capable – refer to equipment submittal
Outside Air Enable / Disable (Open outside air damper when enabled)

B. A wall mounted temperature thermostat located in the space shall provide an analog input signal to the unit's control module.

C. Each unit shall be programmed to start and stop according to the day/night schedule provided by the Owner.

D. The unit fan shall run continuously in the day cycle.

E. On a rise in space temperature above the cooling set point, the compressor shall start. Provide two stage control for units with two steps of capacity.

F. On a drop in space temperature below the heating set point, the electric heat shall start. Provide two stage control for units with two steps of capacity.

G. In the night cycle the unit fan shall be off. On a drop in space temperature below the night setting of 55 degrees F., the fan and the heat shall start.

H. Provide fan status monitoring for the supply fan.

I. During occupied hours, the associated outside air motorized damper shall be open. During morning warm up and during un-occupied hours, the outside air motorized damper shall be closed.

4.2 EXHAUST FANS

A. See fan schedule for type of control for each fan.

4.3 ELECTRIC HEATERS

A. Units shall be controlled by integral thermostat.

4.4 PROJECT START-UP

A. Controls Contractor shall make out start-up cards for all unit and system controllers, as per start up card furnished below, and shall furnish same at Final Completion of project.

B. Final submittal of start-up cards shall be bound in a PDF file, collated with unit start-up cards by unit number. Start-up cards shall be in ascending order by unit number with the unit start-up card located before the programming start-up card. Different types of equipment (fan-coil units, rooftop units, etc.) shall be separated with clearly labeled tabs.

4.5 FIRE ALARM INTERLOCK

A. Contractor shall interlock with the central fire alarm control panel with wiring to contacts, a controller, and programming. Control points for interface with the fire alarm control panel shall be provided for the following:
Monitor
Alarm – An alarm signal from the fire alarm shall shut-down the HVAC
Trouble
Supervision

4.6 SYSTEM ACCEPTANCE

A. Reference section 01770 for general requirements.

4.7 CLOSEOUT DOCUMENTATION

A. Properly completed start-up forms, including the form shown below, documenting proper field quality control and demonstration as outlined in section 1.5 above, shall be received by the Owner prior to granting of substantial completion.

END OF SECTION 230900

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. Condensate-drain piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

   1. Plastic pipe and fittings with solvent cement.
   2. Steel Piping and Fittings.
   3. 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 penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
   4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.4 SUBMITTALS

A. Product Data: For each type of the following: Pressure-seal fittings.
   1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Air control devices.
   3. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of

the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

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

B. 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. Condensate-Drain Piping: 150 deg F

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L

B. DWV Copper Tubing: ASTM B 306, Type DWV.

C. Wrought-Copper Unions: ASME B16.22.

2.3 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 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. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. 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.

G. Solvent Cements for CPVC Piping: ASTM F 493.

H. Solvent Cements for PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:
1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180^{O}F.

D. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condensate-Drain Interior Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Condensate-Drain Exterior Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

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 ball valve, and short NPS 3/4 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 tee fittings in main pipe, with the branch connected to the side of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 23 05 23 "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. Provide expansion loops, expansion joints, anchors, and pipe alignment guides for straight piping runs exceeding 100’.

U. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for identifying piping.

V. Install sleeves for piping penetrations of walls, ceilings, and floors.

W. Install sleeve seals for piping penetrations of concrete walls and slabs.

X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for up to NPS 4: Use dielectric unions.

C. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

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. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
2. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
3. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 : Maximum span, 5 feet ; minimum rod size, 1/4 inch.
2. NPS 1 : Maximum span, 6 feet ; minimum rod size, 1/4 inch.
3. NPS 1-1/4 :Maximum span, 7 feet ; minimum rod size, 3/8 inch.
4. NPS 1-1/2 : Maximum span, 8 feet ; minimum rod size, 3/8 inch.
5. NPS 2 : Maximum span, 8 feet ; minimum rod size, 3/8 inch .
6. NPS 2-1/2 : Maximum span, 9 feet ; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

E. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

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. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. 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.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

I. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

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 bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. 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.

END OF SECTION 23 21 13

SECTION 232300

REFRIGERANT 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. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
   1. Suction Lines for Air-Conditioning Applications: 300 psig.
   2. Suction Lines for Heat-Pump Applications: 535 psig.
   3. Hot-Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
   1. Thermostatic expansion valves.
   2. Solenoid valves.
   3. Pressure-regulating valves.

B. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type L or ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

B. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

C. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24, 115, or 208-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

D. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.

6. Maximum Operating Temperature: 240 deg F .

E. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig.

F. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

G. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

H. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

B. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

C. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

D. Install thermostatic expansion valves as close as possible to distributors on evaporators.
   1. Install valve so diaphragm case is warmer than bulb.
   2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

E. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

F. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 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. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 1/2 : Maximum span, 60 inches ; minimum rod size, 1/4 inch .
2. NPS 5/8 : Maximum span, 60 inches ; minimum rod size, 1/4 inch .
3. NPS 1 : Maximum span, 72 inches ; minimum rod size, 1/4 inch .
4. NPS 1-1/4 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
5. NPS 1-1/2 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
6. NPS 2 : Maximum span, 96 inches ; minimum rod size, 3/8 inch .
7. NPS 2-1/2 : Maximum span, 108 inches ; minimum rod size, 3/8 inch .
8. NPS 3 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .
9. NPS 4 : Maximum span, 12 feet ; minimum rod size, 1/2 inch .

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2 : Maximum span, 10 feet ; minimum rod size, 3/8 inch .
2. NPS 2-1/2 : Maximum span, 11 feet ; minimum rod size, 3/8 inch .
3. NPS 3 : Maximum span, 12 feet ; minimum rod size, 3/8 inch .
4. NPS 4 : Maximum span, 14 feet ; minimum rod size, 1/2 inch .

E. Support multi-floor vertical runs at least at each floor.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

SECTION 233113

DUCTWORK

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. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
6. Sealants and gaskets.
7. Hangers and supports.
8. Exterior ducts and fittings.

B. Related Sections:
1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 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".

1.4 SUBMITTALS

A. Product Data: For each type of the following products:
1. Liners and adhesives.
2. Sealants and gaskets.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

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.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND 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:
      a. Lindab Inc.
      b. McGill AirFlow LLC.
      c. SEMCO Incorporated.
      d. Sheet Metal Connectors, Inc.
      e. Spiral Manufacturing Co., Inc.
      f. Impulse Air
      g. Silver Sheet Enterprises, Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements:
1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.
5. Impulse Air
6. Silver Sheet Enterprises, Inc.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
2. Coat insulation with antimicrobial coating.
3. Cover insulation with polyester film complying with UL 181, Class 1.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections. Minimum gauge of sheet metal shall be as specified below:

GREATEST DIMENSION	MIN. U. S. GAUGE
0" - 12"	26
13" - 30"	24
31" - 54"	22
55" - 84"	20
85" and above	18
Plenum	22

Gauges above are minimum thickness of metal and exceed SMACNA standards in many cases.

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. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. 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.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." Ductwork dimensions shown on the plans are internal dimensions. Ductwork shall be increased in size to accommodate duct liner.
1. Manufacturers: Subject to compliance with requirements:
   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.
2. Performance
   1) Building Interior: Type I, Flexible: R-6, 1.5" thick, 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2) Building Exterior: Type I, Flexible: R-8, 2" thick
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

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- or 0.135-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 2-19, "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. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. 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.

2.6 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.

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 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.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

2.8 EXTERIOR DUCTS

A. All exterior exposed ductwork sections shall be connected using a system consisting of minimum 18 gauge galvanized steel with an integral sealant to create an airtight transverse joint. The system shall utilize a neoprene or extruded butyl gasketing between mating flanges the entire length of the joint. The connection system shall be comparable to a S.M.A.C.N.A. class "J" transverse joint. Each transverse joint shall be weatherproofed using a continuous U.L. listed metal cleat applied over the entire joint. The system shall be by Ductmate Industries, Inc., Ward Duct Connector, Inc., or Engineer and Owner approved equal.

B. All exterior duct shall be constructed to meet SMACNA standards for min. 4" w.c. static pressure. Intermediate section supports shall be angle iron or tie rod type sized per the S.M.A.C.N.A. HVAC Duct Construction Standards - Metal and Flexible - 1995 edition. Reinforcement shall be provided on all sides of duct.

C. All exterior ductwork joints, reinforcements, and longitudinal seams shall be sealed with Sonneborn "Sonolastic NP-1" urethane sealant. Exterior ductwork shall be sealed, wiped, and cleaned with mineral spirits, and finished with a minimum of two coats of galvanized primer. The color of sealant and primer shall be matched, with color selected by the Owner.

D. All exterior ductwork shall be properly sealed to building at penetrations to prevent water entry to building and duct interior.

E. All exterior ductwork shall be primed and painted with a minimum of 2 coats of architect selected color. Coordinate paint requirements with general division.

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. Ductwork, unless noted otherwise, shall be constructed for a positive pressure of 3" W.C. for supply ductwork and a negative pressure of 1.5" W.C. for exhaust and return ductwork. Ductwork reinforcement shall be provided as required by the SMACNA HVAC Duct Construction Standards - Metal & Flexible - Third Edition - 2005 for the pressure class and minimum gauges listed above. **Contractor shall submit a schedule indicating duct gauge and reinforcement methods to be utilized for each duct dimension range outlined above prior to fabricating any ductwork. Minimum metal thickness is listed in Para 2.4A above.** 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 transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

M. Sizes of duct indicated as lined shall be adjusted to accommodate liner thickness maintaining interior dimensions.

3.2 SEAM AND JOINT SEALING

A. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."
   1. For static-pressure classes 3 inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class B:

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. 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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 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. Paint materials and application requirements are specified in Division 09 painting Sections.

3.6 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:
   1. Dishwasher Hood Exhaust Ducts:
      a. Type 304, stainless-steel sheet.
      b. Exposed to View: No. 4 finish.
      c. Concealed: No. 2D finish.
      d. Welded seams and flanged joints with watertight EPDM gaskets.

B. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.
   2. Stainless-Steel Ducts: Galvanized steel.

C. Liner:
   1. Supply- and Return-Air Ducts: Fibrous glass, Type I, 1.5 inch thick.
   2. Transfer Ducts: Fibrous glass, Type I, 1.5 inch thick.

D. Double-Wall Duct Interstitial Insulation:
   1. Supply- and Return-Air Ducts, 16 Inches and Smaller in Diameter or Rectangular Equivalent: 1 inch thick.

2. Supply- and Return-Air Ducts, 18 Inches and Larger in Diameter or Rectangular Equivalent: 1 inch thick.

E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
   a. Velocity 1000 fpm or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
   b. Velocity 1000 to 1500 fpm:
      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.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
   c. Velocity 1500 fpm or Higher:
      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

F. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." 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 23 31 13

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. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Turning vanes.
10. Duct-mounted access doors.
11. Flexible connectors.
12. Flexible ducts.
13. Spin-ins.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. Lloyd Industries, Inc.
   7. Nailor Industries Inc.
   8. NCA Manufacturing, Inc.
   9. Pottorff; a division of PCI Industries, Inc.
   10. Ruskin Company.
   11. SEMCO Incorporated.
   12. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:
1. Material: Galvanized steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum or Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Sleeve: Minimum 20-gage thickness.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades:
1. Multiple, 0.025-inch- thick, roll-formed aluminum.
2. Maximum Width: 6 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Galvanized steel.

I. Tie Bars and Brackets:
1. Material: Aluminum or Galvanized steel.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic.

L. Accessories:
1. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements:
   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. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Nailor Industries Inc.
   g. Pottorff; a division of PCI Industries, Inc.
   h. Ruskin Company.
   i. Trox USA Inc.
   j. Vent Products Company, Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
   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 or Molded synthetic.
   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: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

D. Spin-in fittings:
1. Spin-in fittings shall be used for round take-offs from rectangular duct mains. Spin-ins shall include a scoop extractor and balancing damper with 2" stand-off bracket with locking quadrant and continuous square shaft with end bearings. Scoop shall be located so the balancing handle is located on the sides. The balancing damper handle shall not be located on the top of the spin during installation. See plan details.

E. Use of "Dove-Tail" fittings or connections is prohibited.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:
1. Multiple blade with maximum blade width of 8 inches.
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- diameter; 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.

F. Bearings:
1. Oil-impregnated bronze or Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners. **Where fire dampers are serving stainless steel ductwork, the fire damper shall be constructed of stainless steel.**

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors. **Where fire dampers are serving stainless steel ductwork, the fire damper shall be constructed of stainless steel.**

I.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Hat-shaped, 0.094-inch thick, galvanized sheet steel, with overlapping gusseted or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, interlocking, 0.063-inch thick, galvanized sheet steel.

F. Leakage: Class II

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application.

I. Damper Motors: two-position action.

J. 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. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 09 00 " INSTRUMENTATION AND CONTROL FOR HVAC "
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: [115 V, single phase, 60 Hz] <Insert values>.

K. Accessories:
1. Auxiliary switches for signaling and fan control.
2. Momentary test switch, Test and reset switches

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Hat-shaped, 0.094-inch thick, galvanized sheet steel, with overlapping gusseted or mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Blades: Roll-formed, horizontal, interlocking, 0.063-inch thick, galvanized sheet steel.

I. Leakage: Class II

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: two-position action.

N. 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. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 09 00 " INSTRUMENTATION AND CONTROL FOR HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.

2.9 CEILING DAMPERS

A. Manufacturers: Subject to compliance with requirements:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Prefco; Perfect Air Control, Inc.
7. Ruskin Company.
8. Vent Products Company, Inc.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. General Requirements:
1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

F. Fire Rating: 2 hours.

2.10 TURNING VANES

A. Manufacturers: Subject to compliance with requirements:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements:
1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. 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 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements:
1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. 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 2 strips of 2-3/4-inch- wide, 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. .
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor 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.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.14 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Flexmaster U.S.A., Inc.

2. McGill AirFlow LLC.
3. Thermaflex
4. Atco

B. Insulated, Flexible Duct: UL 181, Class 1, CPE film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Flexible duct insulation shall have a thermal resistance of R-6 or greater.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action for sizes 3 through 18 inches, to suit duct size. **Nylon cable straps are not acceptable for securing flexible duct.**

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 backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

C. 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.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils.
2. Downstream from manual volume dampers, control dampers, turning vanes, and equipment.
3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
4. At each change in direction and at maximum 50-foot spacing.
5. Upstream of turning vanes.

6. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.

J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect variable volume and powered induction terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to low-pressure ducts directly or with maximum 72" lengths of flexible duct. Flexible ducts shall be supports at 36" intervals. Supports shall be attached to the structure and shall not crimp or impede proper airflow though the installed ductwork.

O. Connect flexible ducts to metal ducts with stainless steel draw bands.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

END OF SECTION 23 33 00

SECTION 233423

HVAC POWER VENTILATORS

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. Ceiling-mounted ventilators.
   2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on 1,000-foot elevation.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan Company
3. Breidert Air Products.
4. Broan Mfg. Co., Inc.
5. Delhi Industries Inc.
6. Greenheck.
7. Loren Cook Company.
8. Penn Ventilation.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic grilles for fans from 50 to 200 cfm and painted aluminum grilles for fans greater than 200 cfm, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link. (As indicated on plans.)
3. Isolation: Rubber-in-shear vibration isolators.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan Company
3. Breidert Air Products.
4. Broan Mfg. Co., Inc.
5. Delhi Industries Inc.
6. Greenheck.
7. Loren Cook Company.
8. Penn Ventilation.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.3 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.4 WARRANTIES

A. Fans shall be provided with 1 year warranty from substantial completion.

END OF SECTION 23 34 23

SECTION 233713

DIFFUSERS, REGISTER, AND GRILLES

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. Rectangular and square ceiling diffusers.
2. Louver face diffusers.
3. Adjustable bar registers and grilles.
4. Fixed face registers and grilles.

B. Related Sections:
1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of 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, using 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. Source quality-control reports.

D. The reflected ceiling plan shall be referenced to determine air device frame types. Air devices located in gypsum board ceilings shall be installed with steel surface mount adaptor frame.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   2. Devices shall be specifically designed for variable-air-volume flows.
   3. Material: Steel or Aluminum.
   4. Finish: Baked enamel, white.
   5. Face Size: Per schedule and ceiling type.
   6. Mounting: Per schedule and ceiling type.
   7. Pattern: Fixed.
   8. Dampers: Radial opposed blade.
   9. Accessories:
      a. Equalizing grid.
      b. Plaster ring.
      c. Safety chain.
      d. Wire guard.
      e. Sectorizing baffles.
      f. Operating rod extension.

B. Louver Face Diffuser:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   2. Devices shall be specifically designed for variable-air-volume flows.
   3. Material: Steel or Aluminum.
   4. Finish: Baked enamel, white.
   5. Face Size: Per schedule and ceiling type.
   6. Mounting: Per schedule and ceiling type.
   7. Pattern: Four-way, unless noted otherwise.
   8. Dampers: Radial opposed blade.
   9. Accessories:
      a. Square to round neck adaptor.
      b. Adjustable pattern vanes.
      c. Throw reducing vanes.
      d. Equalizing grid.
      e. Plaster ring.
      f. Safety chain.
      g. Wire guard.
      h. Sectorizing baffles.
      i. Operating rod extension.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   2. Material: Steel or Aluminum.
   3. Finish: Baked enamel, white.
   4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
   5. Core Construction: Integral.
   6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
   7. Frame: 1-1/4 inches wide.
   8. Mounting Frame: Per schedule and ceiling type.
   9. Mounting: Per schedule and ceiling type.
   10. Damper Type: Adjustable opposed blade.

B. Adjustable Bar Grille:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. METALAIRE, Inc.
      c. Nailor Industries Inc.
      d. Price Industries.
      e. Titus.
   2. Material: Steel or Aluminum.
   3. Finish: Baked enamel, white.
   4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
   5. Core Construction: Integral.
   6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
   7. Frame: 1-1/4 inches wide.
   8. Mounting Frame: Per schedule and ceiling type.
   9. Mounting: Per schedule and ceiling type.

C. Fixed Face Register:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. Nailor Industries Inc.
      c. Price Industries.
      d. Titus.
   2. Material: Steel or Aluminum.
   3. Finish: Baked enamel, white.
   4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
   5. Core Construction: Integral.
   6. Frame: 1-1/4 inches wide.
   7. Mounting Frame: Per schedule and ceiling type.
   8. Mounting: Per schedule and ceiling type.
   9. Damper Type: Adjustable opposed blade.

D. Fixed Face Grille:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. Nailor Industries Inc.
      c. Price Industries.
      d. Titus.
   2. Material: Steel or Aluminum.
   3. Finish: Baked enamel, white.
   4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
   5. Core Construction: Integral.
   6. Frame: 1-1/4 inches wide.
   7. Mounting Frame: Per schedule and ceiling type.
   8. Mounting: Per schedule and ceiling type.

2.3 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 practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 234100

PARTICULATE AIR FILTRATION

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 factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

B. Owner retains a filter changing service. Contractor is responsible for permanent filter racks under this contract.

C. The General Contractor shall be responsible for contacting the. Note: No HVAC equipment shall be operated without the filter installed.

1.3 SUBMITTALS

A. Product Data: Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Comply with ARI 850.

C. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.

D. Comply with NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 REPLACEABLE MEDIA PANEL FILTERS

A. Description: Factory-fabricated, replaceable media filters with holding frames.

B. Media: Fibrous material with anti-microbial agent and held in place by self-supporting wire grid of the frame below. Minimum rating MERV-8.

C. Media-Grid Frame: Steel frames with hardware cloth grid in accordance with Owner's filter service standards.

D. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for bolting together into built-up filter banks.

2.2 SIDE-SERVICE HOUSINGS

A. Description: Factory-assembled, side-service housings, constructed of galvanized steel, with flanges to connect to duct system.

B. Access Doors: Continuous gaskets on perimeter and positive-locking devices. Arrange so filter cartridges can be loaded from either access door.

C. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall maintain filters during construction as noted in this section. The filters shall be replaced monthly or sooner depending on jobsite conditions and the amount of airborne debris. The owner or engineer can require the filters to be replaced more often depending on jobsite conditions.

B. Install filter frames according to manufacturer's written instructions.

C. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

D. Install filters in position to prevent passage of unfiltered air.

E. Coordinate filter installations with duct and air-handling unit installations.

3.2 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 23 41 00

SECTION 238127

SPLIT SYSTEM AIR CONDITIONER

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 split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Compressor - Five years from date of Substantial Completion.

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. Carrier Air Conditioning; Div. of Carrier Corporation.
2. Trane
3. Lennox
4. Daikin

2.2 FAN-COIL UNITS

A. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2010.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Heating Coil: Electric resistance coil having a U.L. listed certification, and complete with all operating and safety controls.

D. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor. The external static pressure in schedule on the drawings is for the ductwork and air distribution devices. Unit pressure drop and filter pressure drop shall be added to the external static pressure for a total static pressure.

E. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

F. Disposable Filters: 1 inch thick, in fiberboard frames with ASHRAE 52.2 MERV rating of 8 or higher.

G. Wiring Terminations: Connect motor to chassis wiring with plug connection.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or Scroll.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Refrigerant: R-410a

J. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

2.5 EVAPORATOR COILS

A. Cooling coils shall be seamless copper tubes mechanically boned to aluminum fins. Cools shall be sized to match condensing unit output and equipped with condensate drain pan. Coils shall be provided with thermostatic expansion valves and any additional accessories needed for proper operation and to meet the minimum efficiency requirements.

2.6 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

F. Unit shall be provided with electro-mechanical controls (24-volt terminal strip) for field installation of controller/ programable thermostat.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 27

DIVISION 26

ELECTRICAL SPECIFICATIONS

PREPARED BY

John Averrett, PE

SECTION 26 0001 - ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All Electrical work required.

B. All Telecommunications required.

C. All Low Voltage Systems work required.

1.02 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in the procedure shall be the State Fire Marshal.

D. Electrical: Conform to the National Electrical Code, NFPA 70, 2017 Edition.

E. Energy: Conform to the International Energy Conservation Code, 2009 Edition with all Georgia State Amendments.

F. Accessibility: Conform to Americans with Disability Act.

G. Fire Prevention: Conform to Georgia State Minimum Fire Prevention Code, 2012 Edition, with all Georgia State Amendments.

H. Building Code: Conform to International Building Code, 2012 Edition, with all Georgia State Amendments.

1.03 ELECTRICAL SYSTEM DESCRIPTION

A. A new pad-mounted transformer will be provided by Georgia Power Company. The new pad mounted transformer will be 208/120V 3-phase secondary. Transformer primary conductors shall be by the Power Company, the primary conduit shall be by the contractor based on utility company requirements. The transformer secondary shall be by the Contractor. The transformer pad shall be by the Contractor, in coordination with Power Company requirements.

B. A new 3-phase 4-wire 600Amp main distribution panel (MP) will be provided.

1. 25% spares or spaces will be provided in the main distribution panel.

2. The MP will have ground fault protection for the main breaker.

3. The MP will have a surge protective device (SPD).

C. Sub-panels and feeders will be provided based on the building layout and power needs of various spaces.

1. 25% spare breakers will be provided in all panelboards.

D. Voltage Selection:

1. Motors 1/2 Hp and larger will operate at 208V, 3-phase, unless location or manufacturer requirements dictate otherwise.

2. Motors less than 1/2 Hp will operate at 120V single phase.

3. Lighting will operate at 120V single phase.

E. Receptacles and branch circuits will be provided based on the building layout and power needs of various spaces.

1. Unless noted otherwise, each receptacle branch circuit will have a dedicated neutral.

2. Each office will be on a dedicated circuit.

3. Each cubicle will be on a dedicated circuit.

4. No more than four computers will be on one circuit.

5. General receptacles will be limited to no more than six on one circuit.

F. LED lighting, lighting controls, and switching will be provided based on the building layout and the requirements of each space.

1. Lighting levels will be designed in accordance with the Illuminating Engineering Society Lighting Standards and the Georgia State Energy Code.

2. Interior lighting will be LED, using 2x4 fixtures, pendants, downlights, and specialty lighting as appropriate for each space.

3. Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors and shall not be controlled by automatic means only.

G. Emergency and Exit lighting:

1. Emergency power will be provided by integral emergency battery fixtures.

2. Emergency lighting will be provided in each mechanical and electrical room.

3. Emergency lighting will be provided as a minimum in interior windowless spaces intended for group use. No space requiring emergency lighting can have a single point of failure. Therefore, spaces requiring emergency lighting will have at least two emergency fixtures.

H. Lighting Controls:

1. All spaces will include provisions for automatic shutoff. Occupancy sensors will be utilized where practical (offices, restrooms, meeting rooms, study rooms, etc.). Lighting in very large spaces or spaces with unique geometry or large vertical elements (such as shelves or stacks) will be controlled with a programmable lighting control panel.
2. Each space will contain a local device to control the lights in that space. All lighting controls will be readily accessible. Programmable lighting control panels will be have associated timed override switches, local to the space(s) controlled.
3. Task lighting will be provided with individual switches.
4. Spaces with Audio Visual functions will have programmable dimming controls, interfaced with the AV system, and zoned appropriate to the functions of each space.

I. Grounding:

1. Power system grounding will be provided in accordance with the NEC and as described herein.
2. A new grounding triad consisting of driven ground rods connected by a grounding electrode conductor will be provided.
3. A copper ground bar will be provided adjacent to the MP for connection to the grounding electrode conductor from the triad. This bar will be the common grounding point for all other grounding electrode conductors in the building.
4. A ground bar will be provided adjacent to each dry-type transformer. The separately derived system will be bonded at this bar. These ground bars will be connected together and connected back to the main ground bar adjacent to the MDP with #4/0 bare copper, forming the building grounding riser.
5. Ground plates will be provided in the Data Rooms. These ground plates will be connected together with #4/0 bare copper, and will connect back to the main ground bar adjacent to the MDP from one single point, forming a separate telecommunications grounding riser.
6. Equipment in the Data Room will be bonded to the ground plate in that room with #6 green jacketed cable.
7. A bonding conductor of #6 green jacketed cable will be routed along with and bonded to the building cable tray.
8. Ground rods will be 3/4", 10 long solid copper. Exothermic connections will be used for underground connections.

J. A new discretely addressable fire alarm system shall be provided.

K. A new structured data system will be provided.

L. The following special systems are anticipated in this building. The Contractor will provide all components, equipment, wiring, and programming for these systems. Manufacturers shall match campus standards.

1. Card Access
2. Video surveillance
3. CATV in designated areas

M. Power will be provided to plumbing and HVAC equipment. The contractor will provide all switches, safety disconnects, and enclosed circuit breakers required.

1. Outdoor HVAC equipment will have weatherproof GFCI receptacles within 25-feet to meet NEC maintenance requirements.
2. Power will be routed through the HVAC control device, such as variable frequency drive or starter.
3. Power and fire alarm interface will be provided to smoke control dampers.
4. Any electrical equipment requiring interface to the Building Automation System will be furnished with a factory-installed BACnet interface card/module.

N. Lightning Protection is not anticipated for this building.

1.04 SUBMITTALS

A. Supplementing Division 1 requirements, the Contractor shall:

1. Review the submittal data and check to ensure the compliance with the specifications prior to submitting.
2. Assemble the submittal data in complete sets, with numbered index sheets and tabs. Data shall include product dimensions, voltage, phase, amp ratings, shop drawings, wiring diagrams, product data sheets with characteristics, accessories, and options highlighted.
3. Review the power wiring requirements for the approved HVAC equipment. Provide a tabulation indicating compliance with the electrical connections shown.
4. Wiring Diagrams -Provide for each of the following:
    a. Programmable Lighting Control Panels
    b. Dimming Systems
    c. Fire Alarm System
    d. Structured Data System

5. Layout Drawings - Provide for Occupancy Sensors.

6. Certificates: Provide Manufacturer's Certificates to certify that the installation of major equipment meets or exceeds manufacturer's requirements for:

   a. Fire Alarm System

   b. Lighting Controls - Programmable and Occupancy Sensors

   c. Structured Data System

7. Project Record Documents: The Contractor shall record actual locations of equipment and path of all conduits 3" and larger, and any changes in branch circuiting.

8. Operation Instructions: The Contractor shall instruct the Using Agency on equipment maintenance and system operation using a factory authorized training representative.

9. Operating and Maintenance Manuals: The Contractor shall provide two copies for use by the Using Agency.

1.05 QUALITY ASSURANCE

A. Commissioning Support Requirements:

   1. The Contractor will provide assistance to the Commissioning Authority (CxA) for scheduling and witnessing of testing. The Contractor will review the prefunctional and functional test procedures to ensure feasibility, safety, and equipment protection.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Deliver equipment to project site in protective containers.

B. Store equipment under cover and elevated above grade.

PART 2 PRODUCTS

2.01 SECTION 26 0519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Manufacturers: Made in USA.

B. All conductors shall be copper.

C. Conductors shall be Type THHN/THWN in dry locations, type XHHW in damp or wet locations including underground.

D. MC Cable is not allowed.

E. Conductors shall be a minimum of #10 AWG.

2.02 SECTION 26 0526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. An equipment grounding conductor will be provided in all feeders and branch circuits. Conduit will not be used as the grounding conductor.

B. Ground rods will be 5/8" diameter 10 feet long solid copper.

C. A new triad of new driven ground rods connected by bare copper #3/0 will be provided.

2.03 SECTION 26 2529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

A. Electrical panels, enclosed breakers, and safety disconnect switches on the building interior will be mounted on plywood backboards.

B. Equipment mounted on the exterior will not be mounted on plywood backboards.

C. Hangers and supports will be appropriate for the substrate to which they are attached.

2.04 SECTION 26 0534 CONDUIT

A. All raceway provided under electrical shall be Rigid Metal Conduit (RMC) or Intermediate Metallic Conduit (IMC), except that Electrical Metallic Tubing (EMT) may be used concealed in dry locations.

B. MC Cable will be allowed where concealed inside drywall partitions or above ceilings. No MC Cable will be exposed. All MC Cable shall transition to rigid conduit prior to termination at panelboards.

C. Ten 3/4" EMT conduits shall be provided across all hard ceilings for future use. These conduits shall originate and terminate above accessible ceilings.

D. Final connections to all HVAC and plumbing equipment and to dry type transformers will be liquidtight flexible metallic conduit (LFMC).

2.05 SECTION 26 0536 CABLE TRAYS

A. Metal wire basket/mesh-type cable trays, typically 18" wide by 6" deep will be provided throughout the building to route data cabling.

B. Comply with NEMA VE 1.

C. Zinc Electroplated Steel Finish: Comply with ASTM B633.

D. Manufacturers:

1. Square D: www.squared.com.

2. Thomas & Betts Corporation: www.tnbcabletray.com.

3. Legrand: www.legrand.us
4. Mono-Systems: www.monosystems.com
5. Snake Tray: www.snaketray.com
6. B-Line: www.cooperindustries.com
7. Cope: www.copecabletray.com

2.06 SECTION 26 0537 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

C. Floorboxes and Poke-throughs:

1. Manufacturers and Models for Floorboxes: Legrand Evolution EFB6; Hubbell System-One.

2. Manufacturers and Models for Poke-throughs: Legrand 4FFATC; Hubbell System- One 4".

2.07 SECTION 26 0544 IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. Provide mechanically attached (not adhered), engraved, white on black nameplate with minimum 1/4" high lettering on each panelboard and disconnect switch. Indicate panel name, voltage, and "served from" information.

B. Label each receptacle plate and switch cover with panel and circuit number. These labels shall be typewritten.

C. Mark circuits with a permanent magic marker inside each receptacle box to indicate serving panelboard and circuit number.

D. Clearly label each piece of equipment with panel and circuit number.

E. Provide a dated, typewritten panelboard directory card in plastic window frame on inside of panelboard doors. Clearly indicate the area and devices supplied by each circuit. At the top of the directory type (in bold letters) the location in the building of the breaker which feeds that panel.

F. Electrical equipment requiring preventive maintenance shall be permanently identified.

2.08 SECTION 26 2416 PANELBOARDS

A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.

B. Provide service entrance rated where indicated on plans. At service entrancepanel, provide power meter with local display and capability to connect to building management system. The meter shall measure kilowatts.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:

a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

2. Listed series ratings are not acceptable.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

M. Manufacturers:

1. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

2. GE Industrial: www.geindustrial.com.

3. Square D: www.squared.com.

4. Siemens

2.10 SECTION 26 2417 SURGE PROTECTIVE DEVICES

A. Electrical Requirements:

1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are:

a. Line-to-Neutral

b. Line-to-Ground

c. Line-to-Line

d. Neutral-to-Ground

5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.

6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

a. 480Y/277 Volts:

1) L-N, L-G, N-G = 1200

2) L-L = 2000

b. 208Y/120 Volts:

1) L-N, L-G, N-G = 800

2) L-L = 1200

B. Manufacturers:

1. APT

2. Liebert

3. Square D

4. General Electric

5. Eaton

6. Siemens

7. Surge Suppression, Inc.

2.11 SECTION 26 2726 WIRING DEVICES

A. Switches and convenient outlets shall be white in color.

B. Covers shall be white nylon.

C. Commercial grade wiring devices shall be used, minimum 20 amperes.

D. Ground Fault Circuit Interrupters (GFCIs) will be provided for all exterior circuits including outdoor lighting of all types and all circuits in wet areas such as restrooms, kitchens, etc.

E. Exterior covers shall be weatherproof in-use type.

2.12 SECTION 26 2813 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Use only fuses of voltage, amperage and class compatible with fuse holder or disconnect.

F. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

G. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.13 SECTION 26 2817 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

D. Conductor Terminations: Suitable for use with the conductors to be installed.

E. Provide thermal magnetic circuit breakers unless otherwise indicated.

F. Provide electronic trip circuit breakers where indicated.

G. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

H. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

   a. Indoor Clean, Dry Locations: Type 1.

   b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

3. Provide surface-mounted enclosures unless otherwise indicated.

J. Provide externally operable handle with means for locking in the OFF position.

2.14 SECTION 26 2818 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
3. Visible blades.
4. Non-teasible, positive, quick-make, quick-break mechanism.
5. Line terminal shields.
6. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.
3. Visible blades.
4. Non-teasible, positive, quick-make, quick-break mechanism.
5. Line terminal shields.

C. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.
2. Exterior locations: Type 3R

2.15 SECTION 26 5100 INTERIOR LIGHTING

A. LUMINAIRES

1. Provide products that comply with requirements of NFPA 70.
2. Provide products that are listed and labeled as complying with UL 1598, where applicable.
3. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
4. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, drivers, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
5. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
6. Provide products suitable to withstand normal handling, installation, andservice without any damage, distortion, corrosion, fading, discoloring, etc.
7. Recessed Luminaires:
   a. Ceiling Compatibility: Comply with NEMA LE 4.
   b. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

2.16 SECTION 26 5200 SENSOR LIGHTING CONTROLS

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Where applicable, occupancy sensors shall be wired in a "Manual ON/ Auto OFF" configuration.

D. Set the factory default to Auto OFF at 20 minutes.

E. Manufacturers:

1. The WattStopper
2. Mytech
3. Leviton
4. Hubbell

5. Pass & Seymour
6. Lutron
7. Lightolier
8. Novitas
9. Lithonia

2.17 SECTION 27 1005 STRUCTURED CABLING FOR VOICE AND DATA

A. General:

1. The system shall be a structured data system, with no distinction between voice and data at the work station outlet. The assignment of voice or data shall be made at the telecomm rack.
2. The work station outlet box shall be 2-gang with single-gang plaster ring, with a 1" conduit to the cable tray.
3. A typical outlet shall have two jacks minimum, with more as location dictates.
4. Metal cable tray shall be located above accessible ceilings to route plenum rated cable to the data closet.
5. Telecommunications Rooms shall be lined with 3/4" plywood, 8' high for backboards.
6. Active equipment (routers, hubs, switches, etc.) is not included as part of this contract.

B. Site:

1. A total of four 4” conduits shall be provided into the MDF for provider cabling.

C. Backbone:

1. Four 4" conduits shall be provided from the building MDF to each IDF for backbone cabling. Each 4" conduit shall contain three 1 1/4" innerducts.
2. Backbone cabling from the MDF to each IDF shall consist of the following:
   a. 12 strand single mode fiber optic cable

D. Horizontal cabling:

1. Station cabling shall be Category 6, UTP, #24 AWG, plenum rated, installed in accordance with EIA/TIA 568B standards.
2. All horizontal cabling shall be less than 250 feet in length.
3. Cabling in or under slab on grade shall be wet location rated and shall route all the way to the nearest data closet underground or overhead in conduit for the

entire run. Wet location rated cable is not plenum rated and shall not be routed in the plenum if not in conduit, and shall not be routed in the cable tray.

E. GROUNDING REQUIREMENTS PER THE NEC AND TIA/EIA J-STD-607-A (Commercial Building Grounding and Bonding Requirements for Telecommunication, October 2002)

F. Comply with all applicable TIA/EIA Telecommunications Building Wiring Standards. TIA-526-7, TIA-526-14-A, TIA/EIA-568-1-B, TIA/EIA-568-2-B, TIA/EIA-568-3-B, TIA- 569-B, TIA-570-B, TIA-598-C, TIA/EIA-606-A, J-STD-607-A, and TIA-758-A.

2.18 SECTION 28 3100 FIRE ALARM SYSTEM

A. Fire Alarm System:

1. A new, discretely addressable fire alarm system shall be provided in the facility. The system will be expandable to allow for future devices. All alarm devices shall be combination audio/visual devices with devices located in each office and public or handicap toilet area and any areas where two or more people would gather for work, study, instruction or conferencing. Mounting heights of alarm devices and pull stations will comply with ADA criteria. All fire alarm cabling shall be routed in raceway.

2. Audible/Visual indicators and visual indicators shall be located in the facility according to ADA and NEC codes. Voice evacuation shall be provided where required.

3. Water flow switches and valve indicator switches both inside the building and on the site shall also be connected to the fire alarm panel.

4. A remote graphic annunciator shall be located near the main entrance.

5. Manufacturers: GE/Edwards; Notifier; FCI/Gamewell/Honeywell.

6. Fire alarm cable shall be in factory painted red 1/2" EMT.

7. Interfaces shall be provided to HVAC equipment for Air Handler shutdown, and other equipment as required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions, all regulatory requirements, and NECA 1 - Standard for Good Workmanship in Electrical Construction.

B. All work shall comply with NFPA 70.

C. Install Fire Alarm in accordance with NFPA 72.

D. Maintain clearances and access around electrical equipment as required in NEC Article 110.

3.02 TESTING

A. Testing:

1. The contractor shall measure the impedance to ground from the bus of the main switchgear with all breakers open and the system neutral-to-ground bonding jumper removed.

2. The contractor shall test circuit breakers 100 amps and larger for resistance of contacts, instantaneous trip.

3. The contractor shall perform a megohm test of all phase and neutral conductors from the service transformer, through the main switchgear, through all distribution panelboards and to all branch circuit panelboard main busses.

3.03 STARTING EQUIPMENT AND SYSTEMS

A. Provide manufacturer's field representative to prepare, start, and test:

1. Lighting control systems
2. Fire Alarm System
3. Generator System
4. Access Control System
5. Video Surveillance System
6. Generator

B. Provide manufacturer's representative to train Owner in operation of:

1. Lighting control systems
2. Fire Alarm System
3. Generator System
4. Access Control System
5. Video Surveillance System
6. Generator

C. Operate all circuit breakers and disconnect switches.

D. Adjust equipment for proper operation in accordance with manufacturer's recommendations and requirements.

3.04 ADJUSTING

A. Adjust equipment for proper operation including torque settings in accordance with manufacturer's recommendations and requirements.

3.05 COMMISSIONING TESTS

A. Provide assistance to the Commissioning Authority (CxA) for scheduling and witnessing of testing.

B. Review the Prefunctional and Functional test procedures to ensure feasibility, safety, and equipment protection.

3.06 CLEANING

A. All electrical gear and conduits inside electrical rooms shall be wiped down prior to material completion.

B. All electrical rooms shall be free of construction materials. Sweep and mop floors and equipment bases.

C. Paint equipment where finish has been damaged with retouching of finish to match factory finish.

D. Vacuum debris including metal shards from panel cans prior to installation of interiors.

E. Vacuum the interior of floorboxes prior to installing coverplate and devices.

F. Wipe down all light fixtures, fire alarm devices, and wiring devices prior to material completion.

G. Any wiring devices that have been painted over and cannot be cleaned satisfactorily will be replaced by the contractor.

H. Condition of Work Upon Project Completion:

1. The condition of equipment and work upon project completion shall be NEW and UNDAMAGED. For example, broken fixture lenses and dented or scratched housings shall be replaced. Painted-over wiring devices shall be cleaned or replaced. Do not use tape or other adhesive for temporary labels, as they leave residue. All circuit breaker factory-printed data/information shall be legible and undamaged. Panelboards and transformers shall be free of scratches, dents, and rust. Any equipment or work deemed by the design professional as not meeting the requirement of NEW and UNDAMAGED shall be replaced by the Contractor at no cost to the Owner.

3.07 FINISHING ELECTRICAL EQUIPMENT

A. Use paint systems specified in Section 09 9000 for the substrates to be finished.

B. Leave conduits in electrical and mechanical rooms unfinished.

C. Paint conduits and boxes in finished areas with ceilings exposed to structure in accordance with finish schedule in architectural drawings/specifications.

END OF SECTION

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Work under this item of the Contract shall include the furnishing of all labor, material, equipment, supplies, and services necessary to construct and install the complete electrical systems, including exterior and interior of buildings as shown on the drawings and specified herein.

B. The CONTRACTOR shall base his proposal on the materials specified herein and on the drawings. Reference to a particular product by the manufacturer, trade name, or catalog number establishes the quality standards of materials and equipment required for this installation and is not intended to exclude products equal in quality and similar in design. Where two or more designations are listed, choice shall be optional with the Contractor. The Engineer reserves the sole right to decide the equality of materials proposed for use in lieu of those specified.

1.2 RELATED DOCUMENTS:

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

B. Related work specified elsewhere includes:
1. Division 310000 – Earthwork
2. Division 270000 – Low Voltage
3. Division 230000 - Mechanical

1.3 CODES, PERMITS, AND INSPECTIONS

A. Comply with applicable laws of the community, with latest edition of NEC where not in conflict with those laws, and with the service rules of the local utility company. Obtain and pay for all permits required. After completion of the work, submit certificate of final inspection and approval from the local electrical inspector, certifying that the installation complies with all regulations governing same.

1.4 DRAWINGS AND SPECIFICATIONS

A. Consider as complementary each to the other. What is called for by one shall be as binding as if called for by both. Where conflicts occur, secure clarification from Engineer in advance of bidding; otherwise provide the more expensive quality or quantity. Follow figures in preference to scale dimensions; verify all dimensions and existing conditions.

1.5 CONFLICTS, COORDINATION AND CHANGES

A. In the event that interferences or conflicts develop, the ENGINEER shall decide which equipment shall be relocated regardless of which was first installed. In the interest of avoiding such conflicts, the electrical sub-contractor who is using common space such as mechanical rooms, chases, ceiling space, etc., shall coordinate his work with all other trades and other parts of his own work. If, during this coordination, it is discovered that necessary or desirable changes should be made, advise the ENGINEER and secure his decision in writing.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, accessories and general recommendations, as applicable to materials and finishes for each component.

C. Samples: Provide samples indicated in each Section, representative of products and/or components to be provided.

D. Color Selection: Where a color selection is required and is not preselected, include physical samples of materials and full range of colors available at bid date.

E. Shop Drawings: Provide shop drawings where indicated or otherwise required for complete and proper illustration of products, systems and installation, including in part, showing layouts, details, elevations, edge conditions, joints, corners, profiles, supports, anchorages, trim, flashings, closures, accessories, special details and similar conditions. Distinguish between factory and field assembly work. The manufacturer's technical engineering department shall approve the drawings before they are submitted.

F. Qualification data for manufacturer, Design Engineer, fabricator and installer.

G. Sample of warranties specified and of incidental warranties of components, which are all to be extended to the Owner.

1.7 WARRANTY

A. Warrant the entire electrical system in proper working order. Replace, without additional charge, all work or material which may develop defects (ordinary wear and tear or damage resulting from improper handling excepted) within a period of one year from date of final acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new and shall be listed as approved by the Underwriter's Laboratories, Inc. in every case where a standard has been established for the particular type of material in question.

All work shall be executed in workmanlike manner and shall present a neat and mechanical appearance when completed.

2.2 ELECTRICAL SERVICE

A. General: Coordinate with owner. Provide all material and labor so as to produce a complete installation meeting the owner regulations. The Electrical Contractor shall be responsible for including all fees associated with bringing power to this site in their original bid. Contractor shall include an allowance in their bid of at least $15,000.00 to cover any fees associated with bringing power to this site.

B. Metering: Obtain metering equipment from Utility Company and install in compliance with the Utility Company's requirements.

C. Main Service Equipment: Provide U.L. listed service entrance components as shown or specified hereinafter.

D. Service Feeder: Of type and size shown on Riser Diagram. Extend (2)5" PVC with Poly-Pull 48" deep underground from service equipment to transformer location (verify exact location with Utility Company). Install utility furnished pull boxes as shown on drawings and terminate conduit at transformer as directed by the Utility Company and leave sufficient slack conductors for connection to transformer lugs. Coordinate any increase or decrease in service size with utility.

E. Transformer: Will be furnished and installed by Utility Company on concrete pad for underground service. Installation shall be in accordance with Utility Company standard drawings. Provide connectors as directed by Utility Company for terminating feeder at transformer lugs. Coordinate any increase or decrease in transformer size with utility.

PART 3 - EXECUTION

3.1 VISIT TO SITE

A. Before submitting a bid, visit the site and ascertain all existing conditions. Make such adjustments in work as are required by the actual conditions encountered.

3.2 CUTTING AND CHASING

A. Where possible, all work shall be built in as the job progresses. Where this is not possible, secure approval and do necessary cutting, chasing, etc. required. Do not cut through any structural members without securing approval in advance; such holes shall be neatly cut or drilled – not chipped.

3.3 TRENCHING AND BACKFILLING

A. Do all excavating necessary for installation of work; backfill trenches and excavations after work has been installed and inspected. Backfill within the building and under paved areas shall meet compaction requirements and fill material shall be pit run gravel or similar granular material.

3.4 ELECTRICAL SERVICE INSTALLATION

A. Project Conditions: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated.

B. Notify Project Manager and Owner no fewer than seven days in advance of proposed interruption of electrical service.

C. Indicate method of providing temporary electrical service.

D. Do not proceed with interruption of electrical service without Project Manager's written permission.

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Copper building wire rated 600 V or less.
2. Aluminum building wire rated 600 V or less.
3. Metal-clad cable, Type MC, rated 600 V or less.
4. Armored cable, Type AC, rated 600 V or less.
5. Photovoltaic cable, Type PV, rated 2000 V or less.
6. Mineral-insulated cable, Type MI, rated 600 V or less.
7. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
1. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35,000 V.
2. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
3. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
4. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.3 DEFINITIONS

A. PV: Photovoltaic.

B. RoHS: Restriction of Hazardous Substances.

C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.
   6. Carol Wire and Cable.Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

B. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

C. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type UF: Comply with UL 83 and UL 493.
3. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

E. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

F. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

G. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN, single conductors in raceway. Type XHHW-2, single conductors in raceway

B. Exposed Feeders: Type THHN, single conductors in raceway

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN, single conductors in raceway

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN, single conductors in raceway

E. Feeders Installed below Raised Flooring: Type THHN, single conductors in raceway

F. Feeders in Cable Tray: Type THHN, single conductors in raceway

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN, single conductors in raceway

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN, single conductors in raceway

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN, single conductors in raceway

J. Branch Circuits Installed below Raised Flooring: Type THHN, single conductors in raceway

K. Branch Circuits in Cable Tray: Type THHN, single conductors in raceway

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

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-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Ground bonding common with lightning protection system.
   3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

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

B. Sustainable Design Submittals

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
         1) Test wells.
         2) Ground rods.
         3) Ground rings.
         4) Grounding arrangements and connections for separately derived systems.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL 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.

C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with socket set screw.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal [**one**] [**two**]-piece clamp.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:
   1. Mechanical type, two pieces with stainless steel bolts.
      a. Material: Die-cast zinc alloy.
      b. Listed for direct burial.
   2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch by 10 feet

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
   1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
   2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

E. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
   4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 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.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground

directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
   1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod, extending around the perimeter of area or item indicated.
   1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches from building's foundation.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

3.7 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 tests and inspections.

E. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.
   4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each

location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

F. Grounding system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds:10 ohms.

I. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

B. Related Requirements:
1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

1.4 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. Suspended ceiling components.
   2. Ductwork, piping, fittings, and supports.
   3. Structural members to which hangers and supports will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Luminaires.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Projectors.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in other related sections, to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor: 1.0.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Rating: Class 1.
   2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Stainless steel, Type 316.
3. Channel Width: Selected for applicable load criteria
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c., in at least one surface.
Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Fabco Plastics Wholesale Limited.
   d. Seasafe, Inc.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Channel Width: Selected for applicable load criteria
3. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Conduit and Cable Support Devices: Steel 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 nonarmored 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 made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      Manufacturers: Subject to compliance with requirements, provide products by one of 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.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
   1. NECA 1.
   2. NECA 101
   3. NECA 102.
   4. NECA 105.

5. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps, or single-bolt conduit clamps using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, according to NFPA 70.

C. 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.

D. 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. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69, or spring-tension clamps.
7. To Light Steel: Sheet metal screws.

8. 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 by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide 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 260529

SECTION 260533

RACEWAYS AND BOXES 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Sustainable Design Submittals:

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

D. Samples: For wireways, nonmetallic wireways and surface raceways and for each color and texture specified, 12 inches long.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
   4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube & Conduit; a Tyco International Ltd. Co.
   4. Anamet Electrical, Inc.; Anaconda Metal Hose.
   5. Electri-Flex Co.
   6. Manhattan/CDT/Cole-Flex.
   7. Maverick Tube Corporation.
   8. O-Z Gedney; Unit of General Signal.
   9. Wheatland Tube Co.

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel or aluminum.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. Certain Teed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fiberglass:
   1. Comply with NEMA TC 14.
   2. Comply with UL 2515 for aboveground raceways.
   3. Comply with UL 2420 for belowground raceways.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651A.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 2515A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, 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.

C. Wireway Covers: Screw-cover type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
   Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Thomas & Betts Corporation.
   b. Walker Systems, Inc.; Wiremold Company (The).
   c. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
14. Rittal

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:
1. Material: Cast metal.
2. Type: Fully adjustable or semi-adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:
1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: Rigid Steel Conduit
   2. Concealed Conduit, Aboveground: Rigid Steel Conduit
   3. Underground Conduit: RNC,Type EPC-40-PVC
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC, Type UA only.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed: Rigid Steel Conduit. Raceway locations include the following:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical rooms.
      d. Gymnasiums.
   2. Concealed in Ceilings and Interior Walls and Partitions: EMT
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   4. Damp or Wet Locations: Rigid Steel Conduit
   5. Boxes and Enclosures: NEMA 250, Type 1, Type 3R, or Type 4x stainless steel as indicated on the plans.

C. Minimum Raceway Size: 1/2-inch trade size.

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. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits

and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply

with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from ENT to RNC, Type EPC-40-PVC to Rigid Steel Conduit for vertical turn before rising above floor. Use long radius 90s for conduit 1-1/2” trade size and larger.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings

on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of

60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths

to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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 for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:
1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. 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 Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
   1. Material: Galvanized sheet steel.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers:
      a. Advance Products & Systems. Inc.
      b. BWM Company
      c. CALPICO, Inc.
      d. Flexicraft Industries
      e. Metraflex Company
      f. Pipeline Seal and Insulator, Inc.
      g. Proco Products, Inc.
   2. Sealing Elements: Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
   1. Manufacturer:
      a. HOLDRITE: Reliance Worldwide Company

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel 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.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553

IDENTIFICATION 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Black letters on an white field.
   2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
   1. Color shall be factory applied or field applied for sizes larger than No. 1/0 AWG if authorities having jurisdiction permit.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Colors for 240-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
   4. Colors for 480/277-V Circuits:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow.
   5. Color for Neutral: White.
   6. Color for Equipment Grounds: Green or Green with a yellow stripe.
   7. Colors for Isolated Grounds: Green with white stripe.

C. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 LABELS

A. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable it identifies and that stay in place by gripping action.

B. Self-Adhesive Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 SIGNS

A. Instructional Signs:
1. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.1/4-inch grommets in corners for mounting.

2.5 CABLE TIES

A. Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength: 50lb (22.6kg), minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

C. Provide Arc Flash warning labels on panelboards, MCCS, etc. required by NEC where not already provided by the manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "POWER."
   3. "UPS."

M. Vinyl Wraparound Labels:
   1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Labels:
   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

W. Underground Line Warning Tape:
   1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
   2. Limit use of underground-line warning tape to direct-buried cables.
   3. Install underground-line warning tape for direct-buried cables and cables in raceways.

END OF SECTION 260553

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Time switches.
2. Outdoor and indoor Photoelectric switches.
3. Lighting contactors.
4. Emergency shunt relays.

B. Related Requirements:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with SPST or DPST dry contacts rated for 1800 VA inductive, to operate connected load, complying with UL 773, and compatible with CFL and LED lamps.
   1. Light-Level Monitoring Range: Turn on: 1-3 fc, Turn off/Turn off Ratio 15 max.
   2. Time Delay: Thirty-second minimum, to prevent false operation.
   3. Lightning Arrester: Mov.
   4. Mounting: Twist lock complying with NEMA C136.10, with base.
   5. Failure Mode: Luminaire stays ON.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

END OF SECTION 260923

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.2 RELATED DOCUMENTS:

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

B. Related work specified elsewhere includes:
   1. Section 260500 – Electrical

1.3 SUBMITTALS

A. Submit product data in accordance with Section 260500 or any other related specifications.

1.4 QUALITY ASSURANCE

A. Comply with NEMA PB 1.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and framework requirements as specified on plans.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Panelboards, Over-current Protective Devices, Controllers, Contactors, and Accessories:
      a. Eaton Corp.; Cutler-Hammer Products.
      b. Siemens Energy & Automation, Inc.
      c. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, as indicated on plans.
   1. Rated for environmental conditions at installed location.
      a. Outdoor locations: NEMA 250, Type 3R or 4x SS as indicated.
      b. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall and ceiling or floor.
   5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   6. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
   7. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
   8. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
   3. Isolated Equipment Ground Bus (where indicated on schedules): Adequate for branch circuit equipment ground conductors; insulated from box.
   4. Extra-Capacity Neutral Bus (where indicated on schedules): Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
   5. Split Bus (where indicated on schedules): Vertical buses divided into individual vertical sections.

C. Conductor Connectors: Suitable for use with conductor material.
   1. Main and Neutral Lugs: Mechanical type.
   2. Ground Lugs and Bus Configured Terminators: Compression type.
   3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installations of devices.

2.3 PANELBOARD SHORT-CIRCUIT RAITING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals. Series rating is not acceptable.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Over-current Protective Devices: Circuit Breaker or Fused switch as indicated on plans.

C. Branch over-current protective devices shall be one of the following:
   1. For Circuit Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
   2. For Circuit Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
   3. Fused switches.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers are specified in Section 16410 “Enclosed Switches and Circuit Breakers”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install over-current protective devices and controllers.
   1. Set field adjustable switches and circuit breaker trip ranges.

E. Install filler plates in unused protective device spaces.

F. Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification".

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

Example:

PANEL A
PHASE A – BROWN
PHASE B – ORANGE
PHASE C – YELLOW
NEUTRAL – GRAY
GROUND - GREEN

3.3 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters

and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF PANELBOARDS

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets

1.2 ADMINISTRATIVE REQUIREMENTS:

A. Coordination:
1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.4 INFORMATION SUBMITTALS

A. Field quality-control reports.

1.5 CLOSE OUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in Part 2 articles:
1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device – Kellems (Hubbell).
3. Leviton Mfg. Company, Inc. (Leviton).
4. Pass & Seymour/Lagrand (Pass & Seymour)

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING – DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A; Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-593
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper, 5351 (single), CR5362 (duplex).
      b. Hubbell; HBL5351 (single), HBL5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:
   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper, VGF20.
      b. Hubbell; GFR5352L.
      c. Pass & Seymour; 2095.
      d. Leviton; 7590

2.5 USB CHARGER RECEPTACLE

A. General Description:
   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the USB charger is working.
   4. Shall have two USB ports 3A, 5Vdc, Type A. 2.0.

B. Duplex USB Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide a product equal to the following:
      a. Hubbell: USB20X

C. Toggle Switches: Comply with NEMA WD 1, UL 20, and FS W-S-896.

D. Switches,120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Single Pole:
         1) Cooper, AH1221.
         2) Hubbell; HBL1221.
         3) Leviton; 1221-2.

4) Pass & Seymour; CSB20AC1.

b. Two Pole:
1) Cooper; AH1222.
2) Hubbell; HBL1222.
3) Leviton; 1222-2.
4) Pass & Seymour; CSB20AC2.

c. Three Way:
1) Cooper; AH1223.
2) Hubbell; HBL1223.
3) Leviton; 1223-2
4) Pass & Seymour; CSB20AC3.

d. Four Way:
1) Cooper; AH1224.
2) Hubbell; HBL1224.
3) Leviton; 1224-2
4) Pass & Seymour; CSB20AC4.

E. Pilot-Light Switches, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper, AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.
c. Leviton; 1221-LH1.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.
2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off" F.

F. Key-Operated Switches, 120/277 V, 20A
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper: AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper, 6252.
b. Hubbell; DR15.
c. Leviton; 16252.
d. Pass & Seymour; 26252.

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and US 943 Class A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; VGF15.
b. Hubbell; GF15LA.
c. Leviton; 8599.
d. Pass & Seymour; 1594

C. Toogle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper, 7621 (single pole), 7623 (three way).
      b. Hubbell; DS115 (single pole), DS315 (three way).
      c. Leviton; 56291-2 (single pole), 5623-2 (three way).
      d. Pass & Seymour; 2621 (single pole), 2623 (three way).

D. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 7631 (single pole), 7633 (three way).
      b. Hubbell; DS120IL (single pole), DS320 (three way).
      c. Leviton; 5631-2 (single pole), 5633-2 (three way).
      d. Pass & Seymour; 2625 (single pole), 2626 (three way).
   2. Description: With neon-lighted handle, illuminated when switch is “off:”

2.7 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: 0.035-inch-(1-mm-) thick, satin-finished stainless steel.
   3. Material for Unfinished Spaces: Galvanized steel.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in “wet locations.”

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant aluminum heavy-duty “in-use”, lockable cover.

2.8 FINISHES

A. Device Color:
   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. 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 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 black walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is compete.

C. Conductors:

1. Do no strip insulation from conductors until right 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.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in it 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 moments.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing meter-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair finished and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. 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, multi-gang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through- type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles.
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damage conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests inspections.

D. Prepare test and inspection reports.

END OF WIRING DEVICES

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fuses rated 600 V and less.
   1. Cartridge fuses rated 600 V and less for use in switches, panelboards, switchboards, controllers, and motor-control centers.
   2. Spare-fuse cabinets.

1.2 RELATED DOCUMENTS:

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

B. Related work specified elsewhere includes:
   1. Section 260500 – Electrical

1.3 SUBMITTAL

A. Submit product data in accordance with Section 260500 and other related specification sections.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source by a single manufacturer.

B. Comply with NEMA FU 1.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and

products.

B. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
   1. Cooper Bussmann, Inc.
   2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
   3. Ferraz Shawmut, Inc.
   4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: “SPARE FUSES” in 1-1/2-inch high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L time delay (601A-6000A); RK1 time Delay (0-600A).

B. Feeders: Class L time delay (601A-6000A); RK1 time delay (0-600A).

C. Motor Branch Circuits: Class RK1 time delay.

D. Other Branch Circuits: Class RK1 time delay.

3.2 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse. Verify indicated fuse sizes with equipment nameplate and installation instructions.

B. Install spare-fuse cabinet(s).

C. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF FUSES

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Molded-case circuit breakers.
   4. Enclosures.

1.2 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Spares: For the following:
      a. Potential Transformer Fuses: 1 set for each ampere rating used for the project.
      b. Control-Power Fuses: 1 set for each ampere rating used for the project.
      c. Fuses and Fusible Devices for Fused Circuit Breakers: 1 set for each ampere rating used for the project.
      d. Fuses for Fusible Switches: 1 set for each ampere rating used for the project.
      e. Fuses for Fused Power Circuit Devices: 1 set for each ampere rating used for the project.
   2. Spare Indicating Lights: Six of each type installed.

1.3 RELATED DOCUMENTS:

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

B. Related work specified elsewhere includes:
   1. Section 260500 - Electrical

1.4 SUBMITTALS

A. Product Data: Submit data in accordance with Section 260500 and other related specification sections.

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. Square D/Group Schneider
   2. Siemens Energy & Automation, Inc.

3. Eaton Corporation; Cutler-Hammer Products.

B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD heavy duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD heavy duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. 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.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:
1. Square D/Group Schneider.
2. Siemens Energy & Automation, Inc.
3. Eaton Corporation; Cutler-Hammer Products.
4. General Electric

B. Molded-Case Circuit-Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents as indicated on plans.
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.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories: Features and Accessories shall apply when noted on plans
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment
4. Ground-Fault Protection: relay and trip unit with adjustable pickup and time delay settings, push-to-test feature, and ground-fault indicator.

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

D. Listing: The circuit breaker ampere rating shall be readily legible (without removing interior cover) on switch handle facing away from the breaker. Legible text shall be high contrast in relation to breaker molding, example if breaker molding is black, use legible white text.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1, Type HS to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
2. Corrosive Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 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 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

SECTION 264113

LIGHTNING PROTECTION FOR STRUCTURES

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 lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:
   1. Ordinary structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
   2. Include raceway locations needed for the installation of conductors.
   3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
   4. Include roof attachment details, coordinated with roof installation.
   5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lightning protection cabling attachments to roofing systems and accessories.
   2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
   3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 017839 "Project Record Documents."
      b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:
   1. UL Master Label Certificate

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Approved by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are

1. Comply with UL 96 and NFPA 780.

Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

2. East Coast Lightning Equipment Inc.
3. ERICO International Corporation.
4. Harger.
5. Heary Bros. Lightning Protection Co. Inc.
6. Independent Protection Co.

7. Preferred Lightning Protection.
8. Robbins Lightning, Inc.
9. Thompson Lightning Protection, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class II buildings.

B. UL Lightning Protection Standard: Comply with UL 96A requirements for Class II buildings.

C. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application

2.3 MATERIALS

A. Air Terminals:
   1. Copper unless otherwise indicated.
   2. 12.5 diameter by 450 millimeters long.
   3. Pointed tip.
   4. Threaded base support.

B. Air Terminal Bracing:
   1. Copper.
   2. 12.5 millimeters diameter rod.

C. Class II Main Conductors:
   1. Stranded Copper: 167,800 circular mils in diameter.

D. Secondary Conductors:
   1. Stranded Copper: 133,100 circular mils in diameter.
      Ground Loop Conductor: Stranded copper.

E. Ground Rods:
   1. Material: Copper-clad steel.
   2. Diameter: 18.75 millimeters.
   3. Rods shall be not less than 3000 millimeters long each.
   4. Sectional type, with integral threads, total length 9000 millimeters each.

F. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 60000 millimeters of building. Comply with requirements for concealed installations in UL 96A and concealed systems in NFPA 780.
   1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
   2. Install conduit where necessary to comply with conductor concealment requirements.
   3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: bolted connector or exothermic weld. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Perform inspections as required to obtain a UL Master Label for system.
   2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

END OF SECTION 264113

SECTION 264313

SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 SPDs for low-voltage power, control, and communication equipment.

B. Related Sections include the following:
1. Division 26 Section "Wiring Devices" for devices with integral SPDs.
2. Division 26 Section "Switchboards" for factory-installed SPDs.
3. Division 26 Section "Panelboards" for factory-installed SPDs.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. TVSS: Transient voltage surge suppressor (known now as SPD.)

D. SPD: Surge Protection Device

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
1. UL 1283.
2. UL 1449 3rd edition.

C. Qualification Data: For testing agency.

D. Field quality-control test reports, including the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Failed test results and corrective action taken to achieve requirements.

E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

SCHEDULE 1 - Provide test reports from a recognized independent testing laboratory verifying the COMPLETE SPD will survive the published and specified maximum surge current rating. Test reports will clearly show that all components that make up a COMPLETE system were included in these tests (including but not limited to all necessary fuses, thermal disconnects, integral disconnects and monitoring systems).

SCHEDULE 2 - Provide data confirming that the SPD will survive the published and specified repetitive surge current rating (longevity characteristic).

SCHEDULE 3 - Per the requirements of NEC Article 285.6, provide test data demonstrating that the SPD is capable of surviving the published and specified short circuit current capability (AIC rating) without the use of external fusing.

SCHEDULE 4 - Provide a COMPLETE set of test and ratings data per the recommendations of NEMA LS1 – 1992.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing

Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

D. 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.

E. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."

F. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F.
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

C. Placing into Service: Do not energize or connect service entrance equipment, panelboard, control terminals, data terminals, to their sources until the surge protective devices are installed and connected.

1.7 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

B. Coordinate surge protection devices with Division 26 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

A. General Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within ten (10) years from date of Substantial Completion.

B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Liebert Corporation; a division of Emerson.
   2. Surge Suppression, Inc.
   3. Advanced Protection Technologies, Inc.
   4. Current Technology, Inc.
   5. Cutler-Hammer, Inc.; Eaton Corporation.
   6. Intermatic, Inc.
   7. LEA International.
   8. Square D; Schneider Electric.

B. Manufacturers of Category A and Telephone/Data Line Suppressors:
   1. EDCO
   2. NTE Electronics, Inc.
   3. Telebyte Technology, Inc.

2.2 SERVICE ENTRANCE SUPPRESSORS

A. Surge Protection Device Description: Non-modular type:

The SPD will be provided with the following features and accessories:

1. Repetitive Rating: SPD shall be capable of surviving at least 10,000 ANSI/IEEE C62.41 Category C3 impulses (10kA) without failure or less than 10% degradation of original performance characteristics.
2. Fusing system to provide 200kAIC short circuit rating.
3. Individually fused MOVs to provide system redundancy
4. Integral disconnect (only when a breaker is NOT provided in distribution equipment)
5. LED indicator lights for power and protection status.
6. Audible alarm, with silencing switch, to indicate when protection has failed.
7. One set of dry contacts rated at 5A and 250V ac, for remote monitoring of protection status.
8. NEMA 12 Enclosure.

B. Surge Protection Device Description: Modular type:

The modular SPD will be provided with the following features and accessories:

1. Repetitive Rating: SPD shall be capable of surviving at least 15,000 ANSI/IEEE C62.41 Category C3 impulses (10kA) without failure or less than 10% degradation of original performance characteristics.
2. Fusing system to provide 200kAIC short circuit rating.
3. Fabrication using bolted compression lugs for internal wiring.
4. Integral disconnect switch (only when a breaker is NOT provided in distribution equipment).
5. Individually fused MOVs to provide system redundancy.
6. Built-in push-to-test feature that tests the integrity of each fuse/MOV pair. Manufacturers who accomplish by use of an external surge generator will provide the device with their quotation.
7. Redundant replaceable modules
8. Arrangement with copper bus bars and for bolted connection to phase buses, neutral bus, and ground bus.
9. Arrangement with wire connection to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.
11. Audible alarm, with silencing switch, to indicate when protection has failed.
12. One set of dry contacts rated at 5A and 250V ac, for remote monitoring of protection status.
13. Surge event operations counter.
14. NEMA 4 Enclosure

C. Peak Single-Impulse Surge Current Rating: 250 kA per phase, 125kA per mode. Manufacturer will provide a higher maximum surge current rating if necessary to meet the repetitive requirements listed above. Connection Means:

D. Connection Means: Permanently wired.

E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277, 208Y/120, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 400 V for 208Y/120 and 700V for 480Y/277V.
2. Line to Ground: 400 V for 208Y/120 and 700V for 480Y/277V.
3. Neutral to Ground: 400 V for 208Y/120 and 700V for 480Y/277V.

F. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

G. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

H. Protection modes and UL 1449 SVR for voltages of 240, 480, or 600, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: 2000V for 480V, 1000V for 240V, 2500V for 600V.
2. Line to Ground: 2000V for 480V, 1000V for 240V, 2500V for 600V,

2.3 PANELBOARD SUPPRESSORS

I. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
2. Audible alarm, with silencing switch, to indicate when protection has failed.
3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

J. Surge Protection Device Description: Modular design with field-replaceable modules, sign-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
10. Surge-event operations counter.

K. Peak Single-Impulse Surge Current Rating: 80 kA per phase.

L. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120.

2. Line to Ground: 400 V for 208Y/120.
3. Neutral to Ground: 400 V for 208Y/120.

M. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

N. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

O. Protection modes and UL 1449 SVR for voltages of 240, 480, or 600, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: 1000 V for 240 V.
2. Line to Ground: 800 V for 240 V.

2.4 SUPPRESSORS FOR BRANCH PANELS

A. Surge Protection Device Description: Sine-wave-tracking type, panel-mounted design with the following features and accessories:
1. LED indicator lights for power and protection status.
2. Audible alarm, with silencing switch, to indicate when protection has failed.
3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
5. Fusing system to provide 200kAIC short circuit rating.
6. Repetitive Rating: SPD shall be capable of surviving at least 6,000 ANSI/IEEE C62.41 Category C3 impulses (10kA) without failure or less than 10% degradation of original performance characteristics.
7. NEMA 4X Enclosure

B. Peak Single-Impulse Surge Current Ratings; 130 kA per phase, 65kA per mode. Manufacturer will provide a higher maximum surge current rating if necessary to meet the repetitive requirements listed above.

C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277 208Y/120, 600Y/347, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 for 480Y/277, 400V for 208Y/120, 1200V for 600Y/347.
2. Line to Ground: 800V for 480Y/277, 400V for 208Y/120, 1200V for 600Y/347.
3. Neutral to Ground: 800V for 480Y/277, 400V for 208Y/120, 1200V for 600Y/347.

D. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.

2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

E. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

F. Protection modes and UL 1449 SVR for voltages of 240, 480, or 600, 3-phase, 3-wire, delta circuits shall be as follows:
1. Line to Line: Line to Line: 2000V for 480V, 1000V for 240V, 2500V for 600V.
2. Line to Ground: 2000V for 480V,1000V for 240V, 2500V for 600V.

2.5 PLUG-IN SURGE SUPPRESSORS

A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
2. LED indicator lights for reverse polarity and open outlet ground.
3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
4. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
5. Close-coupled direct plug-in.
6. Rocker-type on-off switch, illuminated when in the on position.
7. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.

B. Peak Single-Impulse Surge Current Rating: 26 kA per phase.

C. Protection modes and UL 1449 SVR shall be as follows:
1. Line to Neutral: 475 V.
2. Line to Ground: 475 V.
3. Neutral to Ground: 475 V.

2.6 ENCLOSURES

A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Locate the externally mounted SPD as close as possible to the panelboard neutral lug. Locate the recommended breaker as close as

possible to the SPD location. The panelboard manufacturer will supply the breaker. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

C. Provide a 60A, multi-pole circuit breaker in the service entrance equipment and a 30A, multi- pole circuit breaker in branch panel equipment to serve as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 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.

3.3 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect panelboards to their sources until surge protection devices are installed and connected.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
   1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Testing: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:

C. Testing: Perform the following field tests and inspections and prepare test reports:
   1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
   2. Complete startup checks according to manufacturer's written instructions.
   3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 01 Section "Demonstration and Training."

B. Train Owner’s maintenance personnel on procedures and schedules for maintaining suppressors.

C. Review data in maintenance manuals. Refer to Division 1 Section “Contract Closeout.”

D. Review data in maintenance manuals. Refer to Division 1 Section “Operation and Maintenance Data.”

E. Schedule training with Owner, through Architect, with at least seven days’ advanced notice.

END OF SECTION 264313

SECTION 26 51 19

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following types of LED luminaires:
1. Cylinder.
2. Downlight.
3. Highbay, linear.
4. Linear industrial.
5. Lowbay.
6. Parking garage.
7. Recessed linear.
8. Strip light.
9. Surface mount, linear.
10. Surface mount, nonlinear.
11. Suspended, linear.
12. Suspended, nonlinear.
13. Materials.
14. Finishes.
15. Luminaire support.

B. Related Requirements:
1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 26 09 26 "Lighting Control Panelboards" for panelboards used for lighting control.
3. Section 26 09 33 "Central Dimming Controls" or Section 26 09 36 "Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
4. Section 26 09 43 . 16 "Addressable-Luminaire Lighting Controls" and Section 26 09 43 . 23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

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 IES LM-79.
      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. Sustainable Design Submittals:

D. Samples: For each luminaire and for each color and texture with standard factory-applied finish.

E. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
   1. Include Samples of luminaires and accessories involving color and finish selection.

F. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.

G. 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. Luminaires.
   2. Suspended ceiling components.
   3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
   4. Structural members to which equipment and luminaires will be attached.
   5. Initial access modules for acoustical tile, including size and locations.
   6. Items penetrating finished ceiling, including the following:
      a. Other luminaires.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Ceiling-mounted projectors.
   7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

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.
   1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Globes and Guards: One 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.

E. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
   1. Obtain Architect's approval of luminaires in mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 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 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
   1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

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. Standards:
   1. ENERGY STAR certified.
   2. California Title 24 compliant.
   3. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
   4. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
   5. UL Listing: Listed for damp location.
   6. Recessed luminaires shall comply with NEMA LE 4.
   7. User Replaceable Lamps:
      a. Bulb shape complying with ANSI C78.79.
      b. Lamp base complying with ANSI C81.61.

C. CRI of minimum 80. CCT of 3500 K.

D. Rated lamp life of 50,000 hours to L70.

E. Lamps dimmable from 100 percent to 0 percent of maximum light output.

F. Internal driver.

G. Nominal Operating Voltage:
   1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

H. Housings:

1. Extruded-aluminum housing and heat sink.
2. Clear powder-coat finish.

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. 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 SUPPORT

A. Comply with requirements in Section 26 05 29 "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 steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-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 luminaire 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 or attached to a minimum 20 gauge backing plate attached to wall structural members in order to position luminaire accordingly.
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches, 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 wire support 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.

H. 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. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "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.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 26 09 43 . 16 "Addressable-Luminaire Lighting Controls."

B. Comply with requirements for startup specified in Section 26 09 43 . 23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 91 00

OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 SUMMARY

A. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the "On" / "Off" function of the lights.

B. Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aides, or electronic devices such as electronic white board readers. Acceptable programmable shall be Passive Infrared (PIR), and/or PIR/Microphonic Passive Dual Technology (PDT). Ultrasonic or Microwave based sensing technologies shall not be accepted.

C. Time Delay settings shall be factory set at 10 minutes, and shall not be field adjusted unless specifically instructed by Architect. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.

D. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

E. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.

F. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

G. All applicable products must be UL Listed or other acceptable national testing organization.

H. Product must be manufactured in the USA and be warranted for 5 years.

1.2 APPROVED MANUFACTURER AND SUBSTITUTIONS

A. Approved manufacturer shall be Sensor Switch, Inc. (800) 727-7483 www.sensorswitch.com

B. Substitutions must be submitted no less than 5 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the contractor shall bear the responsibility of a fully functional system to the owner's and Architect's satisfaction.

PART 2 – PRODUCTS

2.1 WALL SWITCH SENSORS – SMALL AREAS

A. Sensor shall recess into single gang switch box and fit a standard GFI opening.

B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

C. Sensor shall use PIR sensing incorporating a nominal one half inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 10 feet.

D. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and no switch as specified.

E. In areas with inboard/outboard switching, sensor shall provide two dedicated relays and override switches. Each relay shall have independent programmable time delays.

F. In areas with obstructions to the occupant's workspace, sensor shall utilize programmable dual technology PIR/Microphonic sensing.

G. All models shall have "Reduced Turn On". This is a field programmable function for problematic areas with unforeseen reflective surfaces. False turn on shall be eliminated with this feature.

H. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.

1. WSD (PIR)

2. WSD-2P (PIR inboard/outboard)

3. WSD-PDT (PIR/Microphonic)

4. WSD-PDT-2P (PIR/Microphonic inboard/outboard)

5. WSD-SA (PIR Semi-Automatic)

6. WSD-PDT-SA (PIR/Microphonic Semi-Automatic)

2.2 WALL SWITCH SENSORS – LARGE AREAS

A. Sensor shall surface mount to single gang switch box.

B. Sensor shall use PIR sensing incorporating a nominal one-inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 20 feet.

C. Sensor shall have optional feature for photocell/daylight override.

D. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches.

E. In areas with obstructions to the occupant's workspace, sensor shall utilize dual technology PIR/Microphonic sensing.

F. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.

1. LWS (PIR)

2. LWS-2P (PIR inboard/outboard or two circuits)

3. LWS-PDT (PIR/Microphonic)

4. LWS-PDT-2P (PIR/Microphonic inboard/outboard or two circuits

2.3 LOW VOLTAGE SENSORS

A. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.

B. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.

C. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.

D. Optional interface with Building Automation System (BAS): Each zone designated shall provide one sensor with a SPDT class 2 relay providing a digital input to BAS. All sensors in designated zone shall communicate to sensor with relay for status to BAS. Sensor relay coil shall energize in the unoccupied state to load share the low voltage current from power pack. Note that Power Pack must be installed on the Line side of the local toggle switch for Relay to work properly.

E. Specific sensors shall have optional feature for photocell/daylight override, and/or Low Temperature/High Humidity environments.

F. Sensors shall be the following Sensor Switch model numbers.

1. CM-9 (PIR Ceiling)

2. CM-PDT (PIR/Microphonic Ceiling)

3. CM-10 (PIR Ceiling-Extended Range)

4. CM-PDT-10 (PIR/Microphonic Ceiling-Extended Range)

5. WV-16 (PIR Wall Mount)

6. WV-PDT (PIR/Microphonic Wall Mount)

7. HW-13 (PIR Hallway)

8. HM-10 (PIR High Bay Aisle Way)

9. CM-6 (PIR High Bay)

2.4 POWER PACKS

A. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.

B. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

C. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

D. Power Pack shall incorporate a Class 1 relay and an A/C electronic switching device. The A/C electronic switching device shall make and break the load, while the relay shall carry the current in the On condition. This system shall provide full 20 amp switching of all load types, and be rated for 400,000 cycles.

E. Power Packs shall be single circuit, or two circuits. Slave Packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.

F. Power Packs shall be the following Sensor Switch model numbers.

1. PP-20 (Single Pole)

2. PP-20-2P (Two Pole)

3. SP-20 (Slave Pack)

2.5 PHOTOCELLS AND DIMMING/DAYLIGHT HARVESTING

A. Photocell shall accept 12 to 24 VAC or VDC and provide a SPDT relay for interface with remote switching system. Sensor shall interface with occupancy sensors, directly with power pack, or other system as shown.

B. Photocell shall provide for an On/Off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

C. Photocell set-point and deadband shall be automatically calibrated through the sensor's micro-controller by initiating the "Automatic Set-point Programming" subroutine. Further adjustment may be made manually if needed. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

D. Low voltage Dimming Sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control 0 to 10 VDC dimmable ballasts by sinking up to 20 milliamps of class 2 current (typically 40 or more ballasts).

E. Low voltage Dimming Sensor's set point shall be automatically calibrated through the sensor's micro-controller by initiating the "Automatic Set-point Programming" subroutine. Min and Max dim settings as well as set-point may be manually entered.

F. Low voltage Dimming Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)

G. Combination Photocell/Dimming Sensors shall accept 12 to 24 VAC or VDC (from power pack or other low voltage source) and control the On/Off function as well as the dimming function of 0 to 10 VDC dimmable ballasts.

H. Combination Photocell/Dimming Sensor's set-point and deadband shall be automatically calibrated through the sensor's micro-controller by initiating the "Automatic Set-point Programming" subroutine. Min and Max dim settings as well as set point may be manually entered.

I. Combination Photocell/Dimming Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)

J. Dual zone option shall be available for Photocell, Dimming Sensors, or Combination units. The second zone shall be controlled as an "offset" from the primary zone and shall be the zone farthest from the natural light source.

K. Stand alone Ambient Light Sensors shall interface directly with the 0 to 10 VDC, without any other power source connection, and control dimmable ballasts by sinking up to 20 milliamps of class 2 current. Sensor shall incorporate a photodiode viewing out of a ceiling enclosure at a 30 degree angle from horizontal to detect diffused light from the ambient and artificial sources. Sensor shall allow for removal of response delays for adjustment, however provide dampening delay for normal operation. Settings shall be made manually.

L. Sensors shall be the following Sensor Switch model numbers.

1. CM-PC (Photocell for On/Off)

2. CM-ADC (Dimming Sensor)

3. CM-PC-ADC (Combination Photocell/Dimming Sensor)

4. CM-PC-DZ, CM-ADC-DZ, OR CM-PC-ADC-DZ (Dual Zone Version)

5. CM-ALC (Stand Alone Ambient Light Sensor for Daylight Harvesting)

2.6 LINE VOLTAGE SENSORS

A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.

B. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.

C. Multiple sensors controlling the same load shall be wired in parallel.

D. Wall Mounted Sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.

E. High Bay sensors controlling HID Bi-Level must incorporate a Start to High timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.

F. Specific sensors shall have optional feature for Low Temperature/High Humidity environments.

G. Sensors shall be the following Sensor Switch model numbers.

1. CMR-9 & CMR-9-2P (PIR Ceiling Mount- single and two pole)

2. CMR-PDT & CMR-PDT-2P (PIR/Microphonic Ceiling Mount- single and two pole)

3. CMR-10 & CMR-10-2P (PIR Ceiling Mount Extended Range - single and two pole)

4. CMR-PDT-10 & CMR-PDT-10-2P (PIR/Microphonic Ceiling Mount Extended Range - single and two pole)

5. WVR-16 & WVR-16-2P (PIR Wall Mount single and two pole)

6. WVR-PDT & WVR-PDT-2P (PIR/Microphonic Wall Mount single and two pole)

7. HMR-10 (PIR High Bay Aisle Way)

8. CMR-6 & CMR-6-SH (High Bay Ceiling)

END OF OCCUPANCY SENSORS

SECTION 283111

DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish and install a complete low voltage, automatic and manual fire alarm system as specified herein and indicated on the drawings.

B. The system shall include power supply, signal initiating devices, audible and visual alarm devices, a conduit and wiring system and all necessary accessories required to provide a complete operating system.

C. The system shall comply with the applicable provisions of the National Fire Protection Association Standard Number 72 for fire alarm systems; N.E.C. Article 760; and meet all requirements of the local authorities having jurisdiction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 010000 Specification Sections, apply to this Section.

1.3 DESCRIPTION OF SYSTEM

A. Conduit, outlet boxes, cabinets, devices and wiring installation for complete fire detection and alarm system. Plenum rated cabling may be installed above accessible ceilings with the approval of the local inspecting authority.

B. Each and every item of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer that is currently listed by Underwriter's Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOBZ as a single control unit. Partial listing shall not be acceptable. System controls shall be UL listed for Power Limited Applications per N.E.C. Article 760. All circuits shall be marked in accordance with N.E.C. 760-23.

C. Wiring shown is diagrammatic to define system and is not intended to show every wire. Review drawings prior to bidding and inform Contractor of any additional wiring necessary for installation of systems. Include cost of all wiring in bid.

D. Submit complete shop drawings of system for review including terminal to terminal connection diagrams for system components and associated equipment interfaces, conduit diagrams, complete descriptive information on each item of equipment including UL listing for all system components, and any other information required by Architect to describe system. Identify color code and terminal numbers on shop drawings.
   1. After completion of work, submit one set of record mylar sepias with items for Owner described above. Typical type drawings will not be accepted.

E. Manufacturer's trained technical representative shall supervise installation, connections and tests. The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. Before acceptance, manufacturer's representative will test and certify in writing that system is installed and functioning properly as intended by drawings and specifications. Test includes operation of all devices in entire system.

F. The fire alarm system shall have an integrated off premise communications capability using a Digital Alarm Communications Transmitter (DACT) for sending system events to multiple Central Monitoring Station (CMS) receivers. The system shall provide the CMS(S) with point identification of system events using contact ID protocol. The dialer shall have the capability to support up to two (2) individual accounts and to send account information to two (2) different receivers, each having a primary and secondary telephone access number. System events shall be capable of being directed to one or more receivers depending on event type or location as specified by the system designed. In the event of a panel CPU failure during a fire alarm condition, the DACT degraded mode shall transmit a general fire alarm signal to the CMS. Automatic telephone dialing devices used to transmit an emergency alarm shall not be connected to any fire department telephone number unless approved by the fire chief. It is the fire alarm contractor’s responsibility to coordinate with the owner/architect for transmission paths for the fire alarm control panel (FACP) to be monitored by an approved supervising station in accordance with NFPA72.

G. The Certified Fire Alarm Act became law in Alabama on August 1, 2009 and is enforced effective August 1, 2012. The law requires that every business who installs fire alarm systems in commercial occupancies must be licensed as a Certified Fire Alarm Contractor. The contractor must have a NICET Level III Technician in a position of responsibility, and the license will be issued in the name of the certificate holder and the contractor. The Certified Fire Alarm Act also requires that technicians working for the Certified Contractor must hold a current NICET Level II, or equivalent, certification. Contractors wishing to bid on fire alarm work must show evidence at the pre-bid conference that he/she meets the certification requirements of the Certified Fire Alarm Act and holds a permit issued by the State Fire Marshall.

H. Guarantee entire system in writing for one year from date of acceptance by Owner. Guarantee will cover completely all components, equipment, wiring, etc. Repair any defects found in the system within the guarantee period without cost to owner.

I. Submit with bid a guaranteed price for complete maintenance and service of system for one year beginning at expiration of guarantee period. Price shall be guaranteed for acceptance by Owner until date of substantial completion of system.

1.4 SYSTEM OPERATION

A. Actuation of any alarm initiating device shall cause all audible alarm signals to sound, all visual indicating appliances to flash, cause a red LED on the actuated zone module at the control panel/annunciator to light, provide a signal to the mechanical controls to shut down or re-route air handling systems according to established plans. This shall include a suitable addressable relay at each air handling unit to shut down all air handlers in a given zone when system goes into alarm. In addition all magnetically held doors shall close automatically.

B. The general alarm devices may be silenced by authorized personnel only, by entering a locked cabinet and operating the proper silencing switch. A subsequent zone alarm shall reactivate the signals. Operation of the silencing switch shall be indicated by a trouble light and audible signal.

C. Operation of any pull station, power failure, opens, grounds, or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced; however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

D. Analog Smoke Sensor Operation
   1. The smoke sensor shall be a smoke density measuring device having no self contained alarm set-point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values.
   2. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors and are deemed unacceptable.
   3. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value, a "Dirty Sensor" trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location.
      a. If a "Dirty Sensor" is left unattended, and its average value increases to a second predetermined value, an "Excessively Dirty Sensor" trouble condition shall be indicated at the control panel for the individual sensor.
   4. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor which fails the self-test will cause a "Self Test Abnormal" trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable.

1.5 SYSTEM FEATURES

A. The fire alarm system shall include the following features as a minimum:
   1. Supervision of all field wiring.
   2. Microprocessor based solid state modular construction.
   3. 80 character LCD display to indicate alarms, supervisory service conditions and troubles.
   4. Earth ground supervision circuit.
   5. "Dead Front" design control panel/annunciator with field programmable LED alarm, status and trouble indicators, and all control switches located behind a locked tempered glass door.
   6. Alarm LED and trouble LED for each zone.
   7. Simultaneous test of all LED's from a central point.
   8. Fully automatic battery charger and lead alkaline batteries. Batteries shall have capacity to maintain system operation for 24 hours in normal supervisory mode and shall have sufficient capacity remaining to operate in alarm mode for 15 minutes at conclusion of supervisory period. Batteries shall be supervised for connection to the system and for low voltage threshold. Ammeter and voltmeter shall be provided to indicate battery voltage and charging current.

9. 2 amp form C auxiliary alarm contacts fused with feedback.
10. 2 amp form C auxiliary trouble contacts.
11. Up to 64 class A or class B initiating device circuits (zones) capable of handling 50 addressable alarm initiating devices.
12. Up to 64 two amp alarm indicating circuits.
13. System shall be field programmable for offsite monitoring by remote station reverse polarity, local energy master box or shunt master box types.
14. System shall be field programmable for signal circuit type of operation; march time code, temporal code, selective code, zone code, general alarm, time limit cutout and alarm silence inhibit.
15. Supervised remote annunciator connection circuit.
16. Basic 5 amp power supply (expandable as required).
17. Resident non-volatile programmable operating system memory for all operating requirements.
18. 100 event historical logging.

B. Each zone shall have its own individual alarm indicating light and trouble indicating light.

PART 2 - PRODUCTS

2. 1 FIRE ALARM CONTROL PANELS/ANNUNCIATORS

A. Furnish and install control panels and annunciators as shown on plans.

2.2 ALARM STATIONS - ADDRESSABLE

A. Furnish pull stations as shown on the plans. The station body shall be so constructed that chips and scratches will not expose metal. All stations shall be master keyed with the control equipment. When actuated, the "Pull Lever" shall remain at right angle to the station body until reset.

B. Furnish stations with institutional cover where shown on drawings.

2.3 PHOTOELECTRIC SMOKE SENSOR

A. The addressable smoke sensors shall be of the photoelectric type and shall communicate actual smoke chamber values to the system control panel.

B. The sensors shall be listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.

C. Each sensor base shall contain a LED that will flash each time it is scanned by the control panel (once every 4 seconds). When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor’s base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable.

D. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

E. Each sensor shall be scanned by the control panel for its type identification to prevent inadvertent substitution of another sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.

F. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

G. Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness, if field conditions so require.

H. Provide a U.L. listed sensor guard for sensors in areas subject to tampering. The guard shall be suitable for ceiling or sidewall mounting and hinged for easy access. The guard shall be securely mounted with tamper-proof screws.

2.4 ADDRESSABLE PHOTOELECTRIC DUCT DETECTOR

A. The detector shall be a non-polarized 24VDC type which is compatible with the Fire Alarm Panel and obtains its operating power from the supervisory current in the fire alarm detection loop. It shall be of the same analog type as the ceiling smoke detectors. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.

B. The detector head shall be directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the control panel reset switch.

C. Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Contact between the base and head shall be of the bifurcated type utilizing spring type, self-wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.

D. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.). It shall be possible to alarm the duct housing by using a test switch. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.

E. To minimize false alarms, voltage and RF transient suppression techniques shall be employed as-well-as smoke signal verification circuit and an insect screen.

2.5 HEAT DETECTORS

A. Addressable Thermal Sensors: Shall operate on the "fixed temperature" principle with the sensor having a set point of 135 degrees F, the sensor shall contain dual thermistor sensing circuitry for

fast response.

B. LEDs: Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. LEDs shall pulse periodically indicating that the sensor is receiving power and communication is being supplied. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. Alarm output shall be available for remote annunciation.

C. Interchangeable Sensors: Each sensor shall be interchangeable via twist lock mounting base. To ensure matching proper sensor to potential hazards of areas being protected, the system shall recognize when an improper sensor type has been installed in a previously programmed sensor type location.

2.6 ALARM SIGNALS (AUDIBLE)

A. The horn shall be polarized and shall be operated by 25VRMS. Each horn assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors shall NOT be accepted. Where horns are shown as a combination audio-visual assembly, they shall be mounted as a combination unit in a single back box. Horns shall be capable of producing 88dB and shall be tapped for 2 watt connection.

B. Audio/visual devices required to be surface mounted shall be furnished with surface mounting box and adaptor plate.

2.7 ALARM SIGNALS (VISUALS)

A. Furnish and install visible appliance for fire alarm system notification. The appliance shall be 1HZ synchronized 30 cd with polar distribution or 75 cd illumination as required by the Americans with Disabilities Act (ADA). The appliance shall be U.L. listed to Standard 1971 and have a circumpolar light output allowing mounting in either vertical or horizontal positions or on the ceiling.

1. The light unit shall be of ABS polycarbonate and the lens of high grade, optical quality LEXAN. For optimized light distribution, the xenon flash tube shall be installed perpendicular to the appliance's back plane. A special compound reflector shall be utilized to maximize and best distribute the light pattern in key axis directions.
2. The effect of the illuminated visible appliance shall be observable in a circumpolar pattern. The visible appliance shall be labeled with the word "FIRE" in a contrasting color and the height of each character shall be a minimum of 5/8 inches. In its quiescent state, the word "FIRE" shall be visible.
3. Mounting heights of visual appliances shall in all respects comply with the Americans with Disabilities Act.
4. Visual indicating appliances shall be comprised of a Xenon flashtube and be entirely solid state. These devices shall be U.L. listed and be capable of either ceiling or wall mounting. The LEXAN lens shall be pyramidal in shape to allow better visibility. Visual units shall be of the standalone type.

2.8 AUXILLARY FUNCTIONS

A. Electromagnetic Door Holders.

1. Hold fire and smoke barrier doors open until released by alarm.
2. Holding Power: Approximately 35 pounds (15.9-kg).

3. Offer fail-safe operation.
4. Capable of operation on 12 VDC, 24 VAC, 24 VDC, or 120 VAC interchangeably without need of configuration.
5. Holders: Release through contacts of control panel after alarm has been initiated from any zone. If 120 vac is used for door holders, provide an isolation relay mounted near the door holders to isolate 120 vac from control panel.
6. Circuits: Separately fused.

2.9 MANUFACTURER

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:

B. Manufacturers:
1. Simplex
2. Honeywell Notifier
3. GE/Edwards EST.

C. All equipment shall be listed by UL. All panels and peripheral devices shall be the standard equipment of a single manufacturer and shall display the manufacturer's name on each component.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.

B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

C. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

D. The manufacturer's authorized representative shall provide on site supervision of installation.

E. The manufacturer’s authorized representative shall have as a minimum, a NICET LEVEL II certification.

3.2 TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon

completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.

3.3 WARRANTY

A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

3.4 CERTIFICATION & ACCEPTANCE

A. A factory trained representative of the manufacturer shall supervise final testing of the system in accordance with N.F.P.A. Standard 72H-1984 in the presence of a representative of the authority having jurisdiction. Manufacturer's representative shall be NICET trained and shall have a level II NICET certificate. It shall be subject to the approval and acceptance of the responsible engineer. On completion of the acceptance tests, the Owner or his representative shall be instructed in the operation and testing of the system.

B. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy whichever is earlier. Any equipment shown to be defective in workmanship or material shall be repaired, replaced, or adjusted free of charge.

C. The equipment manufacturer shall be represented by a service organization, and the name of this organization shall be furnished to the Architect and Owner. The service organization shall be located within 50 miles of the job site. The service organization shall furnish, gratis to the Owner, a one year maintenance warranty contract, effective from the date of final acceptance.

D. Electrical contractor is responsible for insuring the fire alarm system is certified and coordinating with the owner to insure system is being monitored before Life Safety/Final inspections as per the requirements of the State Building Commission. These requirements also mandate the Local Fire Marshall to be in attendance. It is suggested the contractor provide documentation of his efforts to achieve the above.

END OF SECTION 283111

OWNERSHIP OF DOCUMENTS AND DISCLAIMER

The Project Manual, Technical Specifications, Drawings, and all other documents relating to this project have been prepared for this individual and particular project, and for the exclusive use of the original Owner, developer or other party so indicated.

Actual project conditions and as-built conditions may vary significantly. Changes made during bidding, negotiations, construction, due to additions or deletions of portions of this project, and/or for other reasons, may not be indicated in these documents.

These documents may not be used or relied upon as a certification of information indicated, or used for any other project, by any third parties or other parties, for any purpose whatsoever, without the prior written consent of Goodwyn, Mills and Cawood, Inc., or prior to receipt of mutually agreed to compensation paid to Goodwyn, Mills and Cawood, Inc., therefor.

Goodwyn, Mills and Cawood, Inc.
Post Office Box 242128
Montgomery, AL 36124-2128
and
Birmingham, Alabama
Mobile, Alabama
Andalusia, Alabama
Vernon, Alabama
Eufaula, Alabama
Huntsville, Alabama
Greenville, South Carolina
Nashville, Tennessee
Atlanta, Georgia