

PROJECT MANUAL

CENTRAL HIGH SCHOOL CAFETERIA REMODEL

Tulsa, Oklahoma

**Construction Documents
November 27, 2024**

Project No. A240040



**TULSA PUBLIC
SCHOOLS**

ARCHITECT / ENGINEER

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KKT

ARCHITECTURE
INTERIORS
ENGINEERING

**SECTION 000107
SEALS PAGE**

OWNER:

TULSA PUBLIC SCHOOLS

3027 S NEW HAVEN AVE
TULSA, OKLAHOMA 74114

ARCHITECT OF RECORD:

KKT ARCHITECTS, INC

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ELECTRICAL ENGINEER OF RECORD:

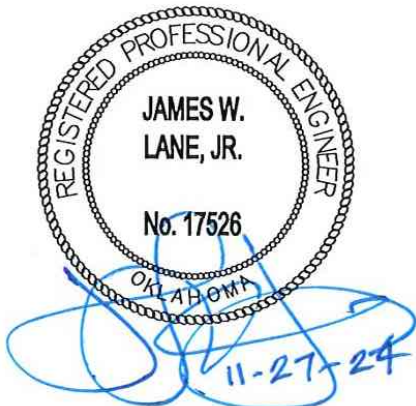
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PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Access to site.
 - 3. Work restrictions.
 - 4. Substitutions.
 - 5. Contract Modifications.
 - 6. Project Management and Coordination.
 - 7. Construction Progress Documentation.
 - 8. Submittals.
 - 9. Quality Requirements.
 - 10. Temporary Facilities and Controls.
 - 11. Product Requirements.
 - 12. Execution.
 - 13. Closeout Procedures.
 - 14. Project Record Documents.
 - 15. Specification and Drawing conventions.
- B. Related Requirements:
 - 1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.03 PROJECT INFORMATION

- A. Project Identification: Central High School Cafeteria Remodel.
- B. The Owner, hereinafter referred to as Owner: TULSA PUBLIC SCHOOLS
- C. Architect's Name: KKT Architects, Inc.
- D. Construction Manager (CM): Trigon, Inc. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

1.04 ACCESS TO SITE

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

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.
- D. Owner Occupancy: Owner will occupy site and existing and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 1. Notify Construction Manager not less than two (2) days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- F. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1.05 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated.
 1. Weekend Hours: 8:00 a.m. to 8:00 p.m.
 2. Hours for noisy activity: 10:00 a.m. to 7:00 p.m.
- C. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

- D. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- E. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site. Maintain list of approved screened personnel with Owner's representative.

1.06 SUBSTITUTIONS

- A. Unless otherwise indicated, after the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of the products in place of those specified only under the conditions set forth below and in the General Conditions (AIA A201).
 - 1. Required for compliance with subsequent interpretation of code requirements or insurance regulation.
 - 2. Unavailability of specified products, through no fault of the Contractor.
 - 3. Subsequent information discloses inability of specified products to perform properly or to fit in designated space.
 - 4. Manufacturer/fabricator refuses to certify or guarantee performance of specified product as required.
 - 5. When it is clearly seen, in the judgment of the Architect that a substitution would be substantially to the Owner's best interest, in terms of cost, time or other considerations.
- B. By making request for substitutions based on Paragraph above, the Contractor:
 - 1. Represents that the Contractor has personally investigated the proposed substitute product and determined that is equal or superior in all respects to that specified;
 - 2. Represents that the Contractor will provide the same warranty for the substitution that the contractor would for that specified;
 - 3. Certifies that the cost data presented is complete and includes all related costs under the Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently became apparent; and
 - 4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
- D. Substitution Requests: Submit electronically 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 facsimile of form provided in this Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.

- b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

1.07 CONTRACT MODIFICATIONS

- A. Minor Changes in the Work: Architect will issue through Construction Manager (CM), supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 "Architect's Supplemental Instructions."
- B. Proposal Requests:
- 1. Owner or Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - a. Work Change Proposal Requests are not instructions either to stop work in progress or to execute the proposed change.

- b. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 2. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager including the following:
 - a. Statement outlining reasons for the change and the effect of the change on the Work.
 - b. List of quantities of products required or eliminated, with total amount of purchases and credits to be made.
 - c. Applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - d. Costs of labor and supervision directly attributable to the change.
 - e. Updated Contractor's construction schedule that indicates the effect of the change.
 3. Architect's/Owner's Review: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a proposal request. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed pricing within 15 days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- C. Change Orders: On Owner's approval of a Work Change Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 "Change Order."
- D. Construction Change Directive: Construction Manager may issue a Construction Change Directive on AIA Document G714 "Construction Change Directive." Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.08 PROJECT MANAGEMENT AND COORDINATION

- 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.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Preparation Format: DWG, operating in Microsoft Windows operating system.
 2. File Submittal Format: Submit or post coordination drawing files using PDF format.

C. Request for Information/Interpretation (RFI):

1. Because the Drawings and specifications are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner.
2. 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.
 - a. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - b. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
3. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - a. Project name.
 - b. Project number.
 - c. Date.
 - d. Name of Contractor.
 - e. Name of Architect and CM.
 - f. RFI number, numbered sequentially.
 - g. RFI subject.
 - h. Specification Section number and title and related paragraphs, as appropriate.
 - i. Drawing number and detail references, as appropriate.
 - j. Field dimensions and conditions, as appropriate.
 - k. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - l. Contractor's signature.
 - m. 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.
4. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
5. Architect's and Construction Manager's Action: Architect and CM will review each RFI, determine action required, and respond in accordance with submittal requirements. 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.
 - a. 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 "Contract Modifications" Article.
 - b. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and CM in writing within ten (10) days of receipt of the RFI response.
6. RFI Log: CM shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 - a. Project name.
 - b. Name and address of Contractor.

- c. Name and address of Architect and CM.
 - d. RFI number including RFIs that were returned without action or withdrawn.
 - e. RFI description.
 - f. Date the RFI was submitted.
 - g. Date Architect's and Construction Manager's response was received.
 7. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and CM within seven (7) days if Contractor disagrees with response.
 8. The Contractor shall keep accurate and detailed written records of the progress of the Work, and shall submit monthly written progress reports to the Owner, including, but not limited to, information concerning the Work of each Subcontractor, the percentage of completion, RFIs, the status of RFIs, the schedule and the number and amount of Change Orders. The Contractor shall also provide the required and actual staffing requirements necessary to complete the Work within the approved Project Schedule. The format of the Contractor's monthly construction reports shall be approved by the Owner. Failure by the Contractor to provide a monthly progress report shall be a condition to the Owner's obligation to make payment to the Contractor. The Contractor shall notify the Owner in writing of any causes for and corrective action to any deviations to the approved Project Schedule.
- D. Project Meetings: CM will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. 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. Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, CM, and Architect, within three (3) working days of the meeting.
 4. Preconstruction Conference: CM will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 5. 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. 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.
 6. Project Closeout Conference: CM will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 7. Progress Meetings: CM will conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.

1.09 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Contractor's Construction Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
- B. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site.
 - 1. List of subcontractors at Project site.
 - 2. Approximate count of personnel at Project site.
 - 3. Equipment at Project site.
 - 4. Material deliveries.
 - 5. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 6. Testing and inspection.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Stoppages, delays, shortages, and losses.
 - 10. Meter readings and similar recordings.
 - 11. Emergency procedures.
 - 12. Orders and requests of authorities having jurisdiction.
 - 13. Change Orders received and implemented.
 - 14. Construction Change Directives received and implemented.
 - 15. Services connected and disconnected.
 - 16. Equipment or system tests and startups.
 - 17. Partial completions and occupancies.
 - 18. Substantial Completions authorized.

1.10 SUBMITTALS

- A. Definitions:
 - 1. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
 - 2. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- B. Submittal Schedule: Submit, as an action submittal, a list 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 CM and additional time for handling and reviewing submittals required by those corrections.

- C. Submittal Formats: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- D. Options: Identify options requiring selection by Architect.
- E. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and CM on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- F. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- G. Submittal Procedures: Prepare and submit submittals required. Types of submittals are indicated in this Section and in individual Specification Sections.
1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect. Architect, through CM, will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 2. Paper (If required): Prepare submittals in paper form, and deliver to Architect.
 3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - b. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - d. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination. Architect and CM reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

4. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - a. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - b. Resubmittal Review: Allow 15 days for review of each resubmittal.
 - c. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 - d. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 5. Resubmittals: Make resubmittals in same form and number of copies as initial submittal. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
 6. 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.
 7. 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.
- H. Submittal Requirements:
1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - a. Mark each copy of each submittal to show which products and options are applicable.
 - b. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
 2. 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.
 - a. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - 1) Identification of products.
 - 2) Schedules.
 - 3) Compliance with specified standards.
 - 4) Notation of coordination requirements.
 - 5) Notation of dimensions established by field measurement.
 - 6) Relationship and attachment to adjoining construction clearly indicated.
 - 7) Seal and signature of professional engineer if specified.

- b. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
- 3. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - a. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - b. Identification: Permanently attach label on unexposed side of Samples.
 - c. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 - d. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
 - e. 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.
- 4. Submission Requirements:
 - a. Coordinate submittals into logical grouping to facilitate interrelation of selections as follows:
 - 1) Submit interior finish samples, including but not limited to finish items specified in Divisions 09, 10, 12, and 14, together. Approval of interior finishes will not be released until all interior finish submittals are received by Architect.
 - 2) Submit exterior finish samples, including but not limited to finish items specified in Divisions 03, 04, 07, 08, and 09, together. Approval of exterior finishes will not be released until all exterior finish submittals are received by Architect.
 - 3) Submit door, frame, and hardware product data, schedules, and other specified submittal information, including but not limited to items specified in Division 08, together.
 - 4) Submit mechanical submittals, including but not limited to items specified in Divisions 21, 22, and 23, together.
 - 5) Submit electrical submittals, including but not limited to items specified in Divisions 25, 26, 27, and 28, together.
 - b. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1) Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination. Allow 15 days for initial review of structural submittals.
 - 2) If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3) Allow 15 days for processing each resubmittal. Allow 15 days for processing structural resubmittals.
 - 4) Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

- 5) No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- c. Identification:
 - 1) Place a permanent label or title block on each submittal for identification.
 - 2) Provide a space approximately 4 by 5 inches on label of beside title block to record Contractor's review and approval markings and action taken by Architect.
- d. Options: Identify options requiring selection by the Architect.
- e. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- f. Number of Copies (If Paper): Submit number of copies required by Contractor, plus one (1) to be retained by Architect, of each submittal, unless otherwise indicated. Architect will return copies.
 - 1) Shop Drawings: If paper, one (1) unfolded reproducible transparency and two (2) opaque reproductions.
 - 2) Refer to Divisions 23 and 26 for Mechanical and Electrical submittal requirements.
 - 3) Product Data: Complete catalogs will not be acceptable. Manufacturer's regular catalog sheets indicating completely all specification requirements, material not directly connected with subject shall be completely lined out. Where drawings cover several sizes or types of construction, they shall clearly indicate size or type of construction to be used including a schedule identifying each piece of equipment. Submittals containing more than five different items of equipment shall be assembled in an indexed brochure.
5. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without reviews, received from sources other than Contractor.
 - a. 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 of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 - b. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
6. Contractor certification of submittal review, to include product verification, field measurements, quantities, coordination with adjacent equipment, structural members, or architectural features, and coordination of information within submittal with requirements of work and Contract Documents. Certification shall be by stamp of approval containing a statement to the effect that they have been reviewed. Uncertified submittals will be rejected.
- I. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect. Architect will not review MSDS's.
- J. Dust-Control and HVAC-Control Plan Submittal: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of the work.
 2. HVAC system isolation schematic drawing.
 3. Location of proposed air filtration system discharge.
 4. Other dust-control measures.
 5. Waste management plan.
- K. Construction Photographs: Submit each digital photographic view within seven (7) days of taking photographs.
1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 3. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.
 4. Digital Images: Submit set of digital image electronic files as a Project Record Document. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.
- L. Delegated-Design Services:
1. 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 insufficient to perform services or certification required, submit a written request for additional information to Architect.
 2. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, 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.
 - a. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
 - b. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- M. Construction Manager's Review: 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.
- N. Architect's Review:
1. Architect Duties:
 - a. Review submittals with reasonable promptness.
 - b. Return submittals to Contractor for distribution, or for resubmission.
 2. Review by the Architect shall not relieve the Contractor from responsibility for errors, which may exist.
 3. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.

- a. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - b. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
 4. Architect's Action Stamp: Architect will stamp each submittal with a submittal stamp and will mark stamp appropriately to indicated action, as follows:
 - a. No Exceptions Taken or Exceptions Taken: Fabrication/purchase may be undertaken (as noted). This does not authorize changes to contract sum or time unless stated in a change order.
 - b. Revise & Resubmit: Fabrication/purchase may not be undertaken. Resubmit corrected copies for final review.
 - c. Review is for the limited purpose of checking for conformance with information given and design concept expressed in the Contract Documents. Review is not conducted for the purpose of determining accuracy and completeness of other details, dimensions, quantities, or substantiating instructions for installation or performance of equipment or systems, all of which remain the sole responsibility of the Contractor. Markings, corrections or comments made on the submittal during this review do not relieve the Contractor from compliance with Contract Documents. Review shall not constitute approval of safety precautions or, of construction means, methods, techniques, sequences or procedures. Review of a specific item shall not indicate approval of an assembly of which the item is a component.
 5. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
 6. Architect's failure to reject Work shall not release Contractor of its obligation to perform the Work in accordance with the Contract Documents or constitute an acceptance of the Work by the Owner or ratification of any substitution or change not otherwise approved in accordance with the Contract.
- O. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- P. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- Q. Architect will discard submittals received from sources other than CM.
- R. Submittals not required by the Contract Documents will be returned by Architect without action.
- S. Use for Construction: Use only final submittals that are marked with appropriate notation from Architect's action stamp.

1.11 QUALITY REQUIREMENTS

- A. 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 4. Specific test and inspection requirements are not specified in this Section.
- B. Mockups: When required by individual specification sections, erect complete, full-scale mockup of assembly at project site. Remove mockup at completion when approved by Architect, unless otherwise indicated.
1. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site separate from permanent construction, consisting of multiple products, assemblies, and subassemblies.
- C. Conflicting Requirements:
1. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements 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 direction 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. 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.
- D. Quality Assurance:
1. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
 2. 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.
 3. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.
 4. 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 design and installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- E. Testing Laboratory Services: Owner shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual specification sections.
1. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
 2. Provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
 3. Cooperate with agencies and representatives 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.
 4. 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.
 5. Services will be performed in accordance with requirements of governing authorities and with specified standards.
 6. Work Included:
 - a. Inspection and testing of soils for compaction, density, moisture content, and identification of proper bearing strata for slabs-on-grade, paving and foundations.
 - b. Inspection and testing of drilled concrete piers including bearing strata, tolerances, dimensions, embedded items, reinforcing, and concrete.
 - c. Inspection and testing of concrete work including design mixes, placement, strength, air content, water content, and curing.
 - d. Inspection and testing of reinforcing for concrete work including steel grade, size, spacing and placement. Inspection and testing of concrete anchors including type, steel grade, size, spacing and placement.
 - e. Inspection and testing of structural steel including anchor bolts, high strength bolts, field and shop welds, and inspection of joists, joist girders, and bridging, as well as grout beneath base plates.
 - f. Inspection and testing of light gage steel including steel deck and steel framing size, gage and connections.
 - g. Keeping daily inspection and test logs of all inspections and tests.
 - h. Submitting to Architect, Engineer, Contractor and Owner all certifications, records and reports of all inspections and tests.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- H. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

- I. 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.
- J. 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.

1.12 TEMPORARY FACILITIES AND CONTROLS

- A. General: In addition to specific responsibilities for temporary facilities and controls indicated in this Section, each contractor is responsible for the following:
 - 1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
 - 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 - 3. Its own storage and fabrication sheds.
 - 4. Temporary enclosures for its own construction activities.
 - 5. Staging and scaffolding for its own construction activities.
 - 6. General hoisting facilities for its own construction activities, up to 2 tons.
 - 7. Progress cleaning of work areas affected by its operations on a daily basis.
 - 8. Secure lockup of its own tools, materials, and equipment.
 - 9. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. CM will provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. CM will provide connections and extensions of services as required for construction operations.
- D. Sanitary Facilities: CM will provide temporary toilets, wash facilities, and drinking water for use of construction personnel, in compliance with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Temporary Heating and Cooling: CM will provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity.
 - 1. CM will provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

2. Air-Filtration Units: CM will provide primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provided with single switch for emergency shutoff, and configured to run continuously.
- F. Telephone Service: CM will provide temporary telephone service in common-use facilities for use by all construction personnel.
- G. Common-Use Field Office and Sheds:
 1. Office: CM will provide office of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
 2. Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
- H. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- I. Temporary Roads and Paved Areas: CM will construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
- J. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
- K. Project Signs: CM will provide temporary Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as required to inform public and individuals seeking entrance to Project.
- L. CM will provide temporary, directional signs for construction personnel and visitors.
 1. Maintain and touch up signs so they are legible at all times.
- M. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent. Comply with ODOT and City of Tulsa standards.
- N. Tree and Plant Protection: CM will provide temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- O. Site Enclosure Fence: Prior to commencing earthwork, CM will furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
- P. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

- Q. Temporary Enclosures: CM will provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- R. Temporary Fire Protection: CM will install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
- S. Termination and Removal: CM will remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1.13 PRODUCT REQUIREMENTS

- A. Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
- B. 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 by Architect through the substitution 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.
- C. Product Options and Substitutions:
 - 1. Requirements Included:
 - a. The Contract is based on the standards of quality established in the Contract Documents.
 - b. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Architect before being incorporated into the work.
 - c. Do not substitute materials, equipment, or methods unless the Architect has specifically approved substitution for this work. If a substitute product is evaluated as unacceptable, the specified or an approved equivalent product shall be furnished, at no additional cost to the Owner.
 - 2. Products List:
 - a. At the time of execution of the Contract, submit to the Architect a pdf copy or five (5) paper copies of complete list of major products, which are proposed for installation.
 - b. Tabulate products by Specification Section number and title.

3. Options:
 - a. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
 - b. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications, as approved by the Architect.
 - c. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
 - d. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product substitution request, if applicable.
 - e. For products specified by naming one or more products or manufacturers, and stating "or equivalent", "or equivalent as approved by the Architect" or "comparable product", etc., in the Contract Documents, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Architect. Submit a request for substitutions, on the SUBSTITUTION REQUEST form, for any product or manufacturer, which is not specifically named. The decision of the Architect shall be final.
 - f. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.
 - g. 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.
4. 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.
 - a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- D. Product Delivery, Storage, and Handling: 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.

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

1.14 EXECUTION

- A. Examination of Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
1. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - a. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - b. Include a summary of safety procedures.
 2. Qualifications: For design of temporary shoring and bracing, employ a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Protect existing work to remain and adjacent construction.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- C. Conflicts and Discrepancies: In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
- D. Construction Layout:
1. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and CM promptly.
 2. Engage a land surveyor to lay out the Work using accepted surveying practices.
 3. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
 4. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
 5. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 6. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

E. Installation of the Work:

1. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
4. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
5. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
6. Verify space requirements and dimensions of items shown diagrammatically on Drawings.
7. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
8. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
9. Repair or remove and replace damaged, defective, or nonconforming Work.

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

1. Definitions:
 - a. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
 - b. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
2. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
3. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
4. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

5. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 6. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 7. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.
- G. Progress Cleaning: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Site: Maintain Project site free of waste materials and debris.
 2. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 3. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 4. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
 5. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 6. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
 7. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- H. Starting and Adjusting:
1. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
 2. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
 3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Protection of Installed Construction:
1. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 2. Comply with manufacturer's written instructions for temperature and relative humidity.

1.15 CLOSEOUT PROCEDURES

A. Substantial Completion Procedures:

1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
2. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - a. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - b. Submit closeout submittals specified, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - c. Submit maintenance material submittals specified, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.
 - d. Submit testing, adjusting, and balancing records.
 - e. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
3. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - a. Advise Owner of pending insurance changeover requirements.
 - b. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - c. Complete startup and testing of systems and equipment.
 - d. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 - f. Advise Owner of changeover in utility services.
 - g. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - h. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - i. Complete final cleaning requirements.
 - j. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
4. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

B. Final Completion Procedures:

1. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - a. Submit a final Application for Payment according to this Section.
 - b. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - c. Submit pest-control final inspection report.
 - d. Submit final completion photographic documentation.
 - e. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
2. When Contractor considers Work is complete, he shall submit written certification that:
 - a. Contract Documents have been reviewed.
 - b. Work has been inspected for compliance with Contract Documents.
 - c. Work has been completed in accordance with Contract Documents, and deficiencies listed with Certificate of Substantial Completion have been corrected.
 - d. Equipment and systems have been tested in presence of Owner's representative and are operational.
 - e. Work is complete and ready for final inspection.
3. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
4. When Architect finds Work is acceptable, he will consider closeout submittals.

C. Closeout Submittals:

1. Evidence of compliance with requirements of governing authorities.
2. Evidence of Payment and Release of Liens: In accordance with General and Supplementary Conditions.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information in electronic format and as indicated.
 - a. Record Drawings: Submit copy of marked-up record drawings.
 - b. Record Specifications: Submit copy of Project's marked-up Specifications, including addenda and contract modifications.
 - c. Record Product Data: Submit a copy of each submittal. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

D. Submittal of Project Warranties:

1. Time of Submittals:

- a. Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
 - b. Make submittals within 10 days after Date of Substantial Completion, before final request for payment. For items of work, where acceptance is delayed beyond Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.
 - c. Prior to Final Payment, furnish Certificates of Warranty in the name of Owner to cover materials, equipment and workmanship from the various manufacturers, suppliers and subcontractors individually who furnish or perform part of the Work.
2. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 3. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 4. Warranties in Paper Form: Provide additional copies of each warranty to include in operation and maintenance manuals.

E. Final Cleaning:

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

F. Repair of the Work: Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

G. Operation and Maintenance Data:

1. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as specified.
2. Format: Submit operations and maintenance manuals in the following format:
 - a. Three (3) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
3. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

- a. Format: 8-1/2" x 11" punch sheets for standard 3-ring binder. Fold larger sheets to fit into binders. Identify each with typed or printed title "OPERATION AND MAINTENANCE DATA".
- b. Binders: Commercial quality, three-ring, with plastic covers.
- 4. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - a. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.
 - b. Format: Same as for initial manual submittal.
 - c. Binders: Same as for initial manual submittal.
- 5. Format: Submit operation and maintenance manuals in the following format:
 - a. Submit draft on digital media acceptable to Architect by email to Architect. Enable reviewer comments on draft submittals.
 - b. Submit three (3) final paper copies in looseleaf binders. Architect, through Construction Manager, will return two (2) copies.
 - 1) Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 - 2) Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider.
 - 3) Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
 - 4) Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

1.16 PROJECT RECORD DOCUMENTS

- A. Closeout Submittals:
 - 1. Record Drawings:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three (3) set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
 - 2. Record Specifications: Submit one (1) paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
 - 3. Record Product Data: Submit annotated PDF electronic files and directories of each submittal. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

4. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- B. Record Drawings:
1. Record Prints: Maintain one (1) set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - a. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - b. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - c. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - d. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
 2. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and CM. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - a. Format: Annotated PDF electronic file with comment function enabled.
 - b. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - c. Refer instances of uncertainty to Architect through CM for resolution.
 - d. Architect will furnish CM with one set of digital data files of the Contract Drawings for use in recording information.
 3. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- C. Record Specifications:
1. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 2. Format: Submit record Specifications as annotated PDF electronic file and scanned PDF electronic file(s) of marked-up paper copy of Specifications.
- D. Record Product Data:
1. 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.
 2. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 3. Format: Submit record Product Data as annotated PDF electronic file and scanned PDF electronic file(s) of marked-up paper copy of Product Data. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

- E. Miscellaneous Record Submittals:
 - 1. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
 - 2. Format: Submit miscellaneous record submittals as PDF electronic file and scanned PDF electronic file(s) of marked-up miscellaneous paper record submittals.
- F. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

1.17 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Where the word "provide" appears, it shall be taken and interpreted to mean, "the Contractor shall furnish all labor, material, equipment and accessory/appurtenances or materials necessary to install and/or complete the Work."
 - 3. Wherever the words 'accepted', 'approved', 'satisfactory', 'directed', 'inspected', or similar words or phrases are used, it shall be interpreted that the words 'by Architect or his representative' follow the word as the object of the clause, such as 'accepted by Architect or his representative'.
 - 4. Wherever the words 'as selected' are used, selections shall be made by the Owner through the Architect.
- B. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. The Mechanical and Electrical Drawings are diagrammatic. Anything shown on the Architectural Drawings and not shown on the Mechanical or Electrical Drawings, or shown on the Mechanical or Electrical Drawings and not shown on the Architectural Drawings, shall be interpreted as being shown on all three. The Contractor shall examine all Drawings prior to bidding and provide all items or work shown on the Drawings, including utility connections.
- E. Wherever dimensions are absent from one Drawing and appears in another is not intended to affect the interpretation of either drawing. Absent dimensions shall be interpreted by the Architect, and shall not be scaled off the Drawings.

- F. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Dimensions: Drawings are representative of the Project and are not to be construed as 'Record Drawings.' Do not scale Drawings to obtain dimensions not indicated.
 4. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

END OF SECTION 010000

SECTION 016400 – OWNER-FURNISHED PRODUCTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Owner Furnished Products.
- B. Related Requirements:
 - 1. Section 010000 – General Requirements: General product requirements related to all products.

1.2 DEFINITIONS

- A. Owner: Defined in Construction Agreement.

1.3 RESPONSIBILITIES FOR OWNER FURNISHED PRODUCTS

- A. Product Delivery: Product supplier will deliver products to jobsite for Contractor to receive on delivery date established by Contractor. Supplier will contact Contractor after Award of Contract to establish a product delivery and installation date, quantities of materials, and a coordination procedure.
- B. Owner Responsibilities:
 - 1. Responsibilities by Owner shall correspond to the party furnishing the product as specified hereinafter.
 - 2. Arrange for delivery of supplier furnished shop drawings, product data, samples, and installation instructions to Contractor.
 - 3. Arrange and pay for product delivery to site, in accordance with agreed upon construction schedule.
 - a. Deliver supplier's shipment list of materials to Contractor.
 - b. Submit claims for transportation damage.
 - c. Arrange for replacement of damaged, defective, or missing items.
 - d. Arrange for manufacturers' warranties, bonds, services, and inspections, as required.
- C. Contractor Responsibilities:
 - 1. Review supplier furnished shop drawings, product data, and samples under provisions of Section 010000. Submit to supplier with notification to Architect, and Owner of any discrepancies or problems anticipated in the use the products.
 - 2. Receive and unload products at the Site when specified.
 - 3. Verify quantity of products furnished with shop drawings, Final Field Use Drawings, or Bills of Lading as applicable.
 - 4. Promptly inspect products upon receipt for shortages, damaged, or defective items; report to Owner. Upon notification, Owner will arrange for delivery of replacement products.
 - 5. Handle products at site, including uncrating, storage, and protection unless otherwise specified.

6. Install products when specified.
7. Provide for installation and hook-up at time of delivery of Owner installed equipment.
8. Protect installed products from damage.
9. Replace items damaged by Contractor.
10. Remove trash, debris, and rubbish.
11. Manufacturing Defects: Report suspected product manufacturing defects to. Upon notification, Owner will arrange for repair of product manufacturing defects.

1.4 CONTRACTOR INSTALLATION OF OWNER FURNISHED PRODUCTS

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of Owner installed products and equipment.
- C. Work in harmony with all subcontractors, suppliers and manufacturers.
- D. Unpack and set in place, plumb, level, and secure.
- E. Connect to mechanical, plumbing, and electrical systems as required.
- F. Remove packaging and clean products.
- G. Test and adjust as required.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 PRODUCTS FURNISHED BY OTHERS SCHEDULE

- A. Equipment will be furnished by the Owner for installation by either the Contractor or by others as specified in the Drawings.
- B. Unless otherwise specified, Contractor shall coordinate delivery date of Owner furnished equipment. If significant order lead times are required for a specific product, lead time shall be as specified for that product.

END OF SECTION 016400

**SECTION 024119
SELECTIVE DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- D. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 DEFINITIONS

- A. Demolition (Demo): Dismantle, raze, destroy or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
 - 2. Demolition firm qualifications.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.07 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of five years of documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

- A. Remove portions of existing buildings as indicated on Drawings.
- B. Remove items specifically indicated for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until existing elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- E. Protect existing structures and other elements to remain in place and not removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. Hazardous Materials:
 - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

3.03 EXISTING UTILITIES

- A. Protect existing utilities to remain from damage.
- B. Do not disrupt public utilities without permit from authority having jurisdiction.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 - 1. Verify construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Maintain building security; take care to prevent unauthorized entry.
- E. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
 - 2. Remove items indicated on drawings.
 - 3. Core Drilling: Core drill slabs as required to install new items as detailed on Drawings. If required based on existing slab conditions, employ methods of detecting existing tensioned and un-tensioned reinforcing, and other embedded items, so as not to damage existing facilities and equipment.
 - 4. Powder-Actuated Fasteners and Post-installed Anchors: Verify existing slab conditions employing methods of detection specified for core drilling; locate fasteners and anchors to avoid structural damage to existing slabs and existing tensioned reinforcing.
- F. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. See Section 011000 - Summary for limitations on outages and required notifications.
 - 4. Verify that abandoned services serve only abandoned facilities before removal.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- G. Protect existing work to remain.
 - 1. Prevent movement of structure. Provide shoring and bracing as required.
 - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; do not burn or bury.

- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural wood casework.
- B. Hardware.
- C. Preparation for installing utilities.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. If not listed, fabricator must provide documentation that they are part of Quality Certification Program (QCP).
 - a. Wood Systems, Inc.
 - b. Southern Millwork, Inc.
 - c. Fadco, Inc.
 - 2. Single Source Responsibility: Provide and install this work from single fabricator.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.06 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
 - 1. Comply with AWI 200.3.2.4 Environmental Control and Relative Humidity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
 - 1. Duty Level: 3
- C. Cabinets:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Semi-Exposed Surfaces: White Melamine.

4. Door and Drawer Front Edge Profiles: 3mm PVC edge banding.
5. Casework Construction Type: Type A - Frameless.
6. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
7. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
 - a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
 - b. Elevation match as noted on drawings.
8. Cabinet Design Series: As indicated on drawings.
 - a. <https://naaws.com/cabinet-design-series/>
9. Adjustable Shelf Loading: 50 psf.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Doweled.
13. Drawer Construction Technique: As recommended by fabricator.

2.03 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.04 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
1. Grade: M-2; moisture resistance at all sinks.
 2. Panel Thickness: 3/4 inch.

2.05 TOE KICK MATERIALS

- A. Marine grade plywood for toe kick construction.

2.06 THERMALLY FUSED LAMINATE PANELS

- A. Thermally Fused Laminate (TFL): Melamine-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
1. Panel Core Substrate: Particleboard.
 2. Color: White.

2.07 LAMINATE MATERIALS

- A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
1. Laminate thicknesses must be greater than 0.035".

2.08 WINDOW SILLS

- A. Solid Surfacing Sheet.
1. Flat Sheet Thickness: 1/2 inch, minimum.
 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 3. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

2.09 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's custom range.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

- D. Concealed Joint Fasteners: Threaded steel.
- E. ADA Toe Kick: 18 gauge powdercoated steel.
 - 1. Offset: 3 inches.
 - 2. Color: Black.
 - 3. Product:
 - a. Wurth; Ez-Kick Metal ADA Toe Kicks: www.wurthwoodgroup.com

2.10 HARDWARE

- A. Metal Z-Shaped Wall Cabinet Support Clips: Paired, cleated, structural anchorage components applied to back of cabinets and walls for wall cabinet mounting.
 - 1. Material: Extruded Aluminum.
 - 2. Products: 1/4in projection 1/4in lift off
 - a. Eagle Mouldings, Inc; Eagle Z-Clips: www.eagle-aluminum.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
 - 1. Manufacturers:
 - a. Hafela; Essentials Collection.
 - b. Substitutions: See Section 016000 - Product Requirements.
- C. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, steel with chrome finish. Provide gang lock where indicated on drawings.
 - 1. Manufacturers:
 - a. CompX National: www.compx.com
 - b. Substitutions: See Section 016000 - Product Requirements.
- D. Drawer Slides:
 - 1. Type: Full extension, ball bearing..
 - 2. Static Load Capacity: Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Features: Provide Soft Close type.
 - 5. Manufacturers:
 - a. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knappeandvogt.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- E. Hinges: European style concealed soft closing type, steel with satin finish. Restrict opening to 90 degrees at adjacent walls.
 - 1. Manufacturers: 110 or 170 degrees open, restrict opening to 90d at adjacent finishes
 - a. Blum, Inc; CLIP top BLUMOTION: www.blum.com/#sle.
 - b. Titus Cabinet Hardware; T-Type Concealed Hinge: www.titusplus.com/us/en/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- F. Wire Grommets: 2 1/2 in dia
 - 1. Manufacturers:
 - a. Doug Mockett: EDP Flip Top Series: www.mockett.com
 - b. Substitutions: See Section 016000 - Product Requirements.
- G. Wire Management System: Fabricator's standard.

2.11 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
- E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
 - 1. Provide center matched panels at each elevation.
 - 2. Provide sequence matching across each elevation.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use concealed joint fasteners to align and secure adjoining cabinet units.
- C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- D. Secure cabinets to floor using appropriate angles and anchorages.

3.03 ADJUSTING

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

**SECTION 068316
FIBERGLASS REINFORCED PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Accessories and trim.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ISO 846 - Plastics - Evaluation of the Action of Microorganisms.
- G. ISO 2812-1 - Paints and Varnishes -- Determination of Resistance to Liquids -- Part 1: Immersion in Liquids Other than Water.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Samples: Submit two samples 4 by 4 inch in size illustrating material and surface design of panels.
- D. Samples: Joint sealant color samples.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

1.05 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers - Panels:
 - 1. Crane Composites, Inc.: www.cranecomposites.com.
 - 2. Glasteel: www.glasteel.com.
 - 3. Kemlite: www.kemlite.com.
 - 4. Marlite, Inc.: www.marlite.com/#sle.
 - 5. Nudo Products, Inc.: www.nudo.com/#sle.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Thickness: 0.09 inch.

2. Attachment Method: Adhesive only, with trim and sealant in joints.
- B. Interlocking Wall Panels:
 1. Surface Texture: Brick pattern, as indicated in drawings.
 2. Color: As indicated in drawings.
 3. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
 4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
 5. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
 6. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Silicone; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

3.03 CLEANING

- A. Remove excess sealant materials from finish surfaces and clean as recommended by panel manufacturer.

3.04 PROTECTION

- A. Protect installed materials from damage due to subsequent construction operations.

END OF SECTION

**SECTION 079200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 092900 - Gypsum Board: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- B. ASTM C834 - Standard Specification for Latex Sealants.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.
- F. SCAQMD 1168 - Adhesive and Sealant Applications.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
 - 6. Substrates for which use of primer is required.
 - 7. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 8. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 9. Sample product warranty.
 - 10. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

- G. Executed warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Interior Joints:
 - a. Do not seal interior joints indicated on drawings as not sealed.
 - b. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
 - c. Seal the following joints:
 - 1) Joints between door frames and window frames and adjacent construction.
 - 2. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with expansion joint cover assemblies.
 - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
 - d. Joints where sealant installation is specified in other sections.
 - e. Joints between suspended ceilings and walls.
- B. Type P - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
 - 1. Type L - Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.
 - 2. Type Sm - Joints between plumbing fixtures and adjoining walls, floors, and counters: Mildew-resistant silicone sealant.
 - 3. Type Sm - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant.
 - 4. Type Esr - Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 - 5. Type Psl - Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.
- C. Definitions:
 - 1. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors for Concealed Locations: Manufacturer's standard.
- C. Colors for Locations Exposed to View: As selected by Architect from Manufacturer's Full Range.
- D. Custom Color-Matched Colors: Where indicated.

2.03 NONSAG JOINT SEALANTS

- A. Type Sm - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Products:
 - a. Momentive Performance Materials, Inc/GE Silicones; SCS1700 Sanitary Sealant: www.siliconeforbuilding.com.
 - b. Pecora Corporation; 860: www.pecora.com.
 - c. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
 - d. Dow Corning Corporation; 786-M.
 - e. Tremco Incorporated; Tremsil 200.
- B. Type P - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
 - 5. Products:
 - a. Pecora Corporation; Dynatrol I-XL: www.pecora.com.
 - b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
 - c. Tremco Incorporated; Dymonic FC.
- C. Type L - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
 - 3. Products:
 - a. Momentive Performance Materials, Inc/GE Silicones; RCS20 Acoustical Latex Sealant: www.siliconeforbuilding.com.
 - b. Pecora Corporation; AC-20+: www.pecora.com.
 - c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
 - e. BASF Building Systems; Sonolac.

2.04 SELF-LEVELING JOINT SEALANTS

- A. Type Psl - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
 - 1. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - 2. Color: To be selected by Architect from manufacturer's standard range.
 - 3. Service Temperature Range: Minus 40 to 180 degrees F.
 - 4. Products:
 - a. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
 - b. W. R. Meadows, Inc; POURTHANE SL: www.wrmeadows.com/#sle.
 - c. Tremco Incorporated; Vulkem 45SSL.
 - d. Pecora Corporation; NR-201.
 - e. Substitutions: See Section 016000 - Product Requirements.
- B. Type Esr - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - 1. Composition: Multicomponent, 100 percent solids by weight.

2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch.
5. Joint Width, Maximum: 1/4 inch.
6. Products:
 - a. Adhesives Technology Corporation; CRACKBOND JF-90
HD: www.atcepoxy.com/#sle.
 - b. Euclid Chemical Company; EUCO 700: www.euclidchemical.com/#sle.
 - c. Mapei; Mapeiflex Joint Sealant EP 90/50: www.mapei.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Sealant Backing Rod, Open-Cell Type: For interior applications not subject to pedestrian or vehicular traffic.
- C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- D. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- E. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- F. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install bond breaker backing tape where backer rod cannot be used.

- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
- J. ASTM C476 - Standard Specification for Grout for Masonry.
- K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.
- O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
- Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate with wall construction for anchor placement.
 - 2. Coordinate installation of hardware.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Door Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.

- D. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of ANSI A250.8 - SDI-100, and as supplemented in this Section.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- C. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoors.org/sdi-certified/#sle>.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- E. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 REGULATORY REQUIREMENTS

- A. Accessibility: Conform to ADA and applicable building codes.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
- C. Inspect hollow metal products upon delivery for damage. Minor damage may be repaired provided refinishing is equal in all respects to new work and is acceptable to Architect; otherwise replace damaged items with new products as specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an ASSA ABLOY Group company: www.assaabloydss.com.
 - 3. Deansteel Manufacturing, Inc.: www.deansteel.com.
 - 4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 6. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 GENERAL DOOR AND FRAME REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Door Edge Profile: Manufacturers standard for application indicated.
 - 4. Typical Door Face Sheets: Flush, unless otherwise indicated on Drawings.
 - 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - a. Prepare doors and frames for hardware in accordance with templates provided under Section 087100 - Door Hardware.

6. Zinc Coating for Typical Interior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Interior Doors, Non-Fire-Rated:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inches, nominal.
 4. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum, for doors up to 42 inches wide.
 2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum, for doors greater than 42 inches wide.
 3. Frame Metal Thickness: 14 gage, 0.067 inch, minimum, for doors with continuous hinges, regardless of width.
 4. Frame Finish: Factory primed and field finished.
- C. Frames for Wood Doors: Comply with general interior metal frame requirements in accordance with corresponding wood door; minimum 16 gage thickness, unless otherwise indicated.
- D. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- E. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- F. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

- A. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. Silencers: Resilient rubber or vinyl, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. For frame installation, use concealed anchors where possible. Where exposed frame anchors are required, countersink fasteners, fill, and sand smooth.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 087100 - Door Hardware.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- E. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

**SECTION 081416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors.

1.02 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with door opening construction, door frame and door hardware installation.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Door Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.
- D. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS).
 - 2. Include certification program label.
- E. Selection Samples: Submit manufacturer's stain color selector guide.
- F. Verification Samples: Submit two samples of door veneer, 6 by 6 inch in size illustrating wood grain, stain color, and sheen.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Specimen warranty.
- I. Warranty, executed in Owner's name.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- D. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
 3. Provide designated labels on shop drawings as required by certification program.
 4. Provide designated labels on installed products as required by certification program.
 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
- E. Obtain all doors of each type specified from a single manufacturer to assure uniformity of appearance and construction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.08 WARRANTY

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:
 1. VT Industries, Inc: www.vtindustries.com/#sle.
- B. Acceptable Manufacturers - Wood Veneer Faced Doors:
 1. Algoma Hardwoods, Inc.: www.algomahardwoods.com.
 2. Haley Brothers: www.haleybros.com/#sle.
 3. Marshfield DoorSystems, Inc.: www.marshfielddoors.com.
 4. Oregon Door: www.oregondoor.com/sle.
 5. Substitutions: See Section 016000 - Product Requirements.

2.02 DOORS

- A. Doors: Refer to Drawings for locations and additional requirements.
 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
 3. Low Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
 - a. Formaldehyde Emission: Not greater than 0.05 mg/m²/hr.
 - b. 2 Ethyl-1 Hexanol Emission: Not greater than 3.00 mg/m²/hr.
 - c. Total VOC Emission: Not greater than 10.00 mg/m²/hr.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.

2.03 DOOR AND PANEL CORES

- A. General Requirement: Provide door cores fully bonded to stiles and rails.
- B. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
 1. Particleboard Core Grade: LD-1 or Grade LD-2.
 2. At contractor's option, provide doors with structural composite lumber core (SCLC) instead of particleboard cores with mid-rail blocking for doors indicated to receive exit devices.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with slip match between leaves of veneer, center balance match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer, solid wood edges, minimum 0.25 inch thick.
 - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
 - 3. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
- B. Facing Adhesive: Type II - water resistant.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - a. Provide solid blocking for other throughbolted hardware.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 - 1. Transparent:
 - a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
 - b. Stain: VT Industries Wheat.
 - c. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 081113.
- B. Door Hardware: See Section 087100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.
- D. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 1. Trim maximum of 3/4 inch off bottom edges.

- E. Use machine tools to cut or drill for hardware.
- F. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.
- C. Restore finish on all edges of shop finished doors before installation, if fitting or machining is required on site.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on the Drawings.

END OF SECTION

**SECTION 083100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products.
- B. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate installation with work of other trades, and obtain information on door sizes and exact locations from other trades.
 - 2. Coordinate placement of rough-in openings with Architect in tiled walls and gypsum board ceilings.
 - 3. Coordinate placement of access doors and panels with locations of toilet partitions and urinal screens so that doors or panels are not placed in conflict with partition or screen locations.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Product Schedule: Include types, locations, sizes, latching or locking provisions & other data pertinent to installation.
- D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.
- E. Project Record Documents: Record actual locations of each access unit.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- C. Basis of Design: Specifications are based on access door types and model numbers by the specified basis of design manufacturer. Access door types manufactured by other acceptable manufacturers are permitted, subject to compliance with specified requirements; and provided that deviations in dimensions and profile are minor, and do not detract substantially from the indicated design intent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:
 - 1. Babcock-Davis: www.babcockdavis.com/sle.
 - a. Non-Fire-Rated Units: BNW Series.
 - b. Fire-Rated Units: BIW Series.
- B. Other Acceptable Manufacturers:
 - 1. Acudor Products Inc.: www.acudor.com.

2. Bauco Access Panel Solutions: www.accesspanelsolutions.com.
 3. Bilco Company: www.bilco.com.
 4. J. L. Industries: www.jlindustries.com.
 5. Karp Associates, Inc.: www.karpinc.com.
 6. Larsen's Manufacturing Co.: www.larsensmfg.com.
 7. Milcor by Commercial Products Group of Hart & Cooley, Inc.: www.milcorinc.com.
 8. Substitutions: See Section 01 6000 - Product Requirements.
- C. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Panel Material: Steel.
 2. Style: Drywall bead type frame.
 3. Doors:
 - a. Doors for Fire-Rated Units: Double-skinned hollow panel, 20 gage minimum thickness.
 - b. Doors for Non-Fire-Rated Units: Single thickness with rolled or turned in edges, 16 gage minimum thickness.
 4. Frames: 16 gage, 0.0598 inch, minimum thickness.
 5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
 6. Insulation for Rated Doors: Non-combustible mineral wool or glass fiber.
 7. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
 8. Finish: Primed.
 9. Size: Fabricate access door frame assemblies to sizes indicated on drawings or, if not indicated, to smallest size which allows free access to concealed work requiring access. Obtain Architect's approval for rectangular sizes.
 - a. Where access to controls, etc. requiring one handed operation within arm's reach is required, provide 8 by 8 inches.
 - b. Where access to controls, etc. requiring two-handed operation or rotation within arm's reach is required, provide 12 by 12 inches.
 - c. Where upper body access is required (such as above ceilings or beyond arm's length) provide 18 by 18 inches.
 - d. Where full body access is required (such as entering a shaft) provide 24 by 24 inches.
 10. Hardware:
 - a. Hinge for Fire-Rated-Units: 175 degree steel hinges with non-removable pin.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Tamperproof tool-operated cam latch.
 - d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
 - e. Gasketing: Extruded neoprene, around perimeter of door panel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Review access panel locations during wall framing rough-in to confirm location is coordinated with interior wall finishes.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.

- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.
- D. Adjust hardware and panels for proper operation.
- E. Remove and replace panels that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for wood doors.
- B. Lock cylinders for doors that hardware is specified in other sections.
- C. Thresholds.
- D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealants for setting door thresholds.
- B. Section 081113 - Hollow Metal Doors and Frames.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Preinstallation Meeting: Convene a preinstallation meeting at least one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2. Installer's Architectural Hardware Consultant (AHC).
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- D. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to ordering door hardware.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Architect.
 - d. Installer's Architectural Hardware Consultant (AHC).
 - e. Hardware Installer.
 - f. Owner's Security Consultant.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Establish keying submittal schedule and update requirements.

4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Flow of traffic and extent of security required.
5. Record minutes and distribute copies within two (2) days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.04 SUBMITTALS

- A. See Section 010000 - General Requirements, for submittal procedures.
- B. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 3. List groups and suffixes in proper sequence.
 4. Provide complete description for each door listed.
 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 6. Include account of abbreviations and symbols used in schedule.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 1. Submit manufacturer's parts lists and templates.
 2. Bitting List: List of combinations as furnished.
- E. Keying Schedule:
 1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- F. Installer's qualification statement.
- G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 1. Lock Cylinders: Ten for each master keyed group.
 2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three (3) years of documented experience.
- B. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 WARRANTY

- A. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 - 1. Closers: Five years, minimum.
 - 2. Exit Devices: Five years, minimum.
 - 3. Locksets and Cylinders: Ten years, minimum.
 - 4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Listed and certified compliant with specified standards by BHMA (CPD).
 - 4. Auxiliary Hardware: BHMA A156.16.
 - 5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Shop Drawing submittal of Door Hardware Schedule.
- E. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 - 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.

4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.

2.02 HINGES

A. Manufacturers:

1. Basis of Design: As scheduled, or comparable product by one of the following.
2. McKinney; an Assa Abloy Group company: www.assaabloydss.com.
3. Hager Companies: www.hagerco.com.
4. Ives: www.us.allegion.com.
5. Pemko Products; ASSA ABLOY Architectural Door Accessories: www.assaabloydss.com.

B. Hinges: Comply with BHMA A156.1, Grade 1.

1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
2. Continuous Hinges: Comply with BHMA A156.26.
3. Provide hinges on every swinging door.
4. Provide ball-bearing hinges at each door, where indicated.
5. Provide non-removable pins on exterior outswinging doors.
6. Provide power transfer hinges where electrified hardware is mounted in door leaf.
7. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches High: Two hinges.
 - b. Doors From 60 inches High up to 90 inches High: Three hinges.
 - c. Doors 90 inches High up to 120 inches High: Four hinges.

2.03 PIVOTS

A. Manufacturers:

1. Basis of Design: As scheduled, or comparable product by one of the following.
2. McKinney or Rixson; an Assa Abloy Group company: www.assaabloydss.com.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Basis of Design: As scheduled, or comparable product by one of the following.
2. Door Controls International: www.doorcontrols.com.
3. Ives: www.allegion.com.
4. Rockwood Products; ASSA ABLOY Architectural Door Accessories: www.assaabloydss.com.

B. Flush Bolts: Comply with BHMA A156.16, Grade 1.

1. Flush Bolt Throw: 3/4 inch, minimum.
2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.

2.05 EXIT DEVICES

A. Manufacturers:

1. Basis of Design: As scheduled.

2. Sargent; an Assa Abloy Group company: www.assaabloydss.com.
 3. Substitutions: Not permitted.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
 2. Provide cylinder with cylinder dogging or locking trim.
 3. Provide exit devices properly sized for door width and height.
 4. Provide strike as recommended by manufacturer for application indicated.
 5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
 6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
 7. For electrical options, provide quick connect plug-in pre-wired connectors.

2.06 LOCK CYLINDERS

- A. Manufacturers:
1. Basis of Design: As scheduled.
 2. Sargent; an Assa Abloy Group company www.assaabloydss.com.
 3. Substitutions: Not permitted.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide standard, electronic, and full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 2. Provide cylinders from same manufacturer as locking device.
 3. Provide cams and/or tailpieces as required for locking devices.
 4. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.07 CYLINDRICAL LOCKS

- A. Manufacturers:
1. Basis of Design: As scheduled.
 2. Sargent; an Assa Abloy Group company: www.assaabloydss.com.
 3. Substitutions: Not permitted.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch diameter.
 2. Latchbolt Throw: 1/2 inch, minimum.
 3. Backset: 2-3/4 inch unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.
 - b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
 - c. Extra-Long-Lip Strikes: Provide for locks used on frames with applied wood casing trim.

- d. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.

2.08 MORTISE LOCKS

- A. Manufacturers:
 - 1. Basis of Design: As scheduled.
 - a. Sargent; an Assa Abloy Group company: www.assaabloydss.com.
 - b. Substitutions: Not permitted.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 - 1. Latchbolt Throw: 3/4 inch, minimum.
 - 2. Deadbolt Throw: 1 inch, minimum.
 - 3. Backset: 2-3/4 inch unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

2.09 CLOSERS

- A. Manufacturers; Surface Mounted:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.
 - 2. Corbin Russwin, Norton, Rixson, Sargent, or Yale; an Assa Abloy Group company: www.assaabloydss.com.
 - 3. LCN, an Allegion brand: www.allegion.com/us.
- B. Closers: Comply with BHMA A156.4, Grade 1.
 - 1. Type: Surface mounted to door.
 - 2. Provide door closer on each exterior door.
 - 3. Provide door closer on each fire-rated and smoke-rated door.
 - 4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
 - 5. At corridor entry doors, mount closer on room side of door.
 - 6. At outswinging exterior doors, mount closer on interior side of door.

2.10 OVERHEAD STOPS AND HOLDERS

- A. Manufacturers:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.
 - 2. Hager Companies: www.hagerco.com.
 - 3. Ives; an Allegion brand: www.allegion.com.
 - 4. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
- B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 - 1. Provide stop for every swinging door, unless otherwise indicated.

2.11 PROTECTION PLATES

- A. Manufacturers:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.
 - 2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.

- 3. Hager Companies: www.hagerco.com.
- 4. Ives, an Allegion brand: www.allegion.com/us.
- B. Protection Plates: Comply with BHMA A156.6.
- C. Metal Properties: Aluminum.
- D. Edges: Beveled, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.
- F. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.12 WALL STOPS

- A. Manufacturers:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.
 - 2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
 - 3. Hager Companies: www.hagerco.com.
 - 4. Ives, an Allegion brand: www.allegion.com.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Type: Bumper, concave, wall stop.
 - 2. Material: Aluminum housing with rubber insert.

2.13 ASTRAGALS

- A. Astragals: Comply with BHMA A156.22.
 - 1. Type: Split, two parts, and with sealing gasket.
 - 2. Material: Aluminum, with neoprene weatherstripping.
 - 3. Provide non-corroding fasteners at exterior locations.

2.14 THRESHOLDS

- A. Manufacturers:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.
 - 2. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 - 3. Hager Companies: www.hagerco.com.
 - 4. National Guard Products, Inc: www.ngpinc.com.
 - 5. Reese Enterprises, Inc: www.reeseusa.com.
 - 6. Zero International, Inc: www.zerointernational.com.
- B. Thresholds: Comply with BHMA A156.21.
 - 1. Provide threshold at each exterior door, unless otherwise indicated.
 - 2. Type: Flat surface.
 - 3. Material: Aluminum, with santoprene weatherstripping.
 - 4. Threshold Surface: Fluted horizontal grooves across full width.
 - 5. Field cut threshold to profile of frame and width of door sill for tight fit.
 - 6. Provide non-corroding fasteners at exterior locations.

2.15 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
 - 1. Basis of Design: As scheduled, or comparable product by one of the following.

2. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
 3. National Guard Products, Inc: www.ngpinc.com.
 4. Reese Enterprises, Inc: www.reeseusa.com.
 5. Zero International, Inc: www.zerointernational.com.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.
 4. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
 5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
 6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.16 SILENCERS

- A. Manufacturers:
1. Basis of Design: As scheduled, or comparable product by one of the following.
 2. Ives, an Allegion brand: www.allegion.com/us.
 3. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.17 KEY CONTROL SYSTEMS

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
1. Provide keying information in compliance with DHI (KSN) standards.
 2. Keying: Grand master keyed.
 3. Include construction keying and control keying with removable core cylinders.
 4. Key to existing keying system.
 5. Supply keys in following quantities:
 6. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
 7. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
 8. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.18 FINISHES

- A. Finishes: Identified in Door Hardware Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.
- E. Do not install surface mounted items until application of finishes to substrate are fully completed.
- F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 - 2. For Aluminum-Framed Storefront Doors and Frames: See Section 084313.
 - 3. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch.
 - b. Exit Devices: 40-5/16 inch.
- G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
 - 1. See Section 079200 for additional requirements.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 010000 - General Requirements.
- B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 010000 - General Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.07 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.
- B. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. NO - Norton
 - 3. PE - Pemko
 - 4. RF - Rixson
 - 5. RO - Rockwood
 - 6. SA - Sargent

END OF SECTION 087100

Set #1 - 105A - 4070

3 Hinges	T4A3786 4 1/2 X 4 1/2	26D	MC
1 Mortise Lockset	ML2057 LWA CT6D	630	CR
1 Core Only	CR8000 RESTRICTED KEYWAY	626	CR
1 Closer	4040XP RWPA TBSRT	AL	LC
1 Protection Plate	K1050 10" x 34"	US32D	RO
1 Wall Stop	406	US32D	RO
3 Door Silencer	608-RKW	GRAY	RO

Set #2 - 105B - 6070

6 Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Steel Mullion	KR4954 7'6"	SP28	VO
2 Exit Device	99L-F x 996L-R&V	US26D, US28	VO
2 LFIC Rim Housing	CR3070-114-6	630	CR
1 LFIC Mortise Housing	CR1070-112-A02-6	626	CR
3 Core Only	CR8000 RESTRICTED KEYWAY	626	CR
2 Closer	4040XP RWPA TBSRT	AL	LC
2 Protection Plate	K1050 10" x 34"	US32D	RO
2 Door Silencer	608-RKW	GRAY	RO

**SECTION 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Resilient flooring.
 - 2. Thin-set tile.
 - 3. Resinous flooring.
 - 4. Other adhesively applied flooring.
- B. Preparation of new and existing concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Adhesive bond testing.
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- F. Patching compound.
- G. Remedial floor coatings.

1.02 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).
- B. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- C. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- D. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete.
- E. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.
- F. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- I. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.

2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 1. Manufacturer's qualification statement.
 2. Certificate: Manufacturer's certification of compatibility with types of flooring and adhesive applied over remedial product.
 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 4. Manufacturer's installation instructions.
 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- D. Testing Agency's Report:
 1. Description of areas tested; include floor plans and photographs if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
 6. Product data for recommended remedial coating.
 7. Submit report to Architect.
 8. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.
- F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.
- G. Copy of RFCI (RWP).

1.05 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

1.08 WARRANTY

- A. Provide manufacturer's warranty covering flooring delamination failures for 10 years minimum.
 - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Self-Leveling Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product
 - 1. Compressive Strength: Minimum 5000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
 - 2. Flexural Strength: Minimum 1000 psi after 28 days, tested according to ASTM C348.
 - 3. Thickness: Capable of thicknesses from 1/2 inch minimum to maximum [10] inch.
- B. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 4. Acceptable Manufacturers:
 - a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
 - b. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - c. LATICRETE International, Inc; SKIM LITE: www.laticrete.com/#sle.
 - d. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
 - e. Schonox HPS North America; Schonox SL Moisture Resistant Floor Patch and Skim Coat.
 - f. Custom Building Products.
 - g. Henry Company.
 - h. Sika; Level SkimCoat.
 - i. Mapei.
 - j. Substitutions: See Section 016000 - Product Requirements.
- C. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

- D. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 2. Use product recommended by flooring manufacturer. In the absence of a recommendation from flooring manufacturer, use testing agency recommendation. In the absence of testing agency recommendation, use one of the following systems.
 3. Acceptable Products:
 - a. Allied Construction Technologies, Inc; AC Tech 2170 FC : www.actechperforms.com/#sle.
 - b. ARDEX Engineered Cements; ARDEX VB 100: www.ardexamericas.com/#sle.
 - c. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
 - d. Floor Seal Technology, Inc; MES 100: www.floorseal.com/#sle.
 - e. ISE Logik Industries; MVEC 710 with MVBP 600.
 - f. LATICRETE International, Inc; LATICRETE VAPOR BAN E: www.laticrete.com/#sle.
 - g. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer: www.sikafloorusa.com/#sle.
 - h. SINAK Corporation; VECT-R: www.sinak.com/#sle.
 - i. USG Corporation; Durock CoverPrep: www.usg.com/#sle.
 - j. UZIN UTZ NORTH AMERICA, INC; UZIN PE 460 with UZIN PE 280: <https://us.uzin.com/#sle>.
 - k. Substitutions: See Section 016000 - Product Requirements.
- E. Remedial Colloidal Silica Floor Treatment: Clear, penetrating floor treatment intended by its manufacturer to vapor-proof concrete slabs by closing capillary system of concrete, and eliminating route of moisture vapor emission while preserving mechanical key for adhesive bonding.
1. Acceptable Products:
 - a. Spray-Lock Concrete Protection; SCP 327: www.concreteprotection.com.
 - b. Substitutions: See Section 016000 - Product Requirements.
- F. Water Vapor Emission Controlling Curing Compound: Single-component curing compound for preventative water vapor emission control for newly placed concrete.
1. Coordinate with curing requirements specified in 033000 - Cast-in-Place Concrete.
 2. Comply with ASTM C309 and ASTM C1315, Type I Class A or C.
 3. Acceptable Products:
 - a. Creteseal Concrete Waterproofing Products, Inc.; Creteseal 2000: www.creteseal.com.
 - b. Floor Seal Technology, Inc.; VaporSeal 309 System: www.floorseal.com.
 - c. SINAK Corporation; VC5: www.sinak.com.
 - d. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 - a. Remove existing coatings and curing agents from surface according to recommendations of remedial coating manufacturer.

- b. Prepare surface according to recommendations of remedial coating manufacturer and according to ASTM D4259.
 3. Preliminary cleaning.
 4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 7. Specified remediation, if required.
 8. Patching, smoothing, and leveling, as required.
 9. Other preparation specified.
 10. Adhesive bond and compatibility test.
 11. Protection.
- B. Remediations:
 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
 - 1. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- E. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
 - 3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION

- A. Comply with requirements and recommendations of manufacturer.
- B. Curing compounds and membrane forming products are usually considered unacceptable by flooring and adhesive manufacturers. If such materials are used, either obtain the approval of the flooring and adhesive manufacturers prior to use.

3.10 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 092900 - Gypsum Board: Execution requirements for anchors for attaching work of this section.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- C. AISI S220 – North American Specification for the Design of Cold-Formed Steel Framing – Nonstructural members.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- G. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- L. ASTM E413 - Classification for Rating Sound Insulation.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate prefabricated work, component details, framed openings, anchorage to structure, acoustic details, and accessories.
 - 2. Describe method for securing studs to tracks, and for blocking and reinforcement of framing connections.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Evaluation Reports: Submit evaluation reports for framing, tracks, anchors, and fasteners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. CEMCO: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
 - 3. Jaimes Industries: www.jaimesind.com/#sle.
 - 4. Marino: www.marinoware.com/#sle.
 - 5. MBA Building Supplies, Inc.: www.mbastuds.com.
 - 6. MRI Steel Framing LLC: www.mristeel framing.com.
 - 7. State Building Products, Inc.: <http://www.statebp.com>.
 - 8. Steel Construction Systems: www.steelconsystems.com/#sle.
 - 9. The Steel Network, Inc: www.SteelNetwork.com/#sle.
 - 10. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING MATERIALS

- A. Design Requirements: Design metal framing to comply with performance requirements, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
 - 1. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members" and ASTM C645, Section 10, unless otherwise indicated.
- B. Performance Requirements:
 - 1. Interior Suspended Gypsum Board Ceilings, Soffits, and Bulkheads: Design and install to provide deflection of not more than L/360 of distance between supports.
 - 2. Interior Metal Stud/Gypsum Board Assemblies: Design and install to withstand lateral loading (air pressure) of 5 PSF with deflection limit not more than L/240 of partition height.
 - 3. Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Design and install to withstand lateral loading (air pressure) with deflection limit not more than L/360 of partition height.
 - 4. Where documents indicate a stud size, size shall be considered minimum. Increase gage to meet minimum performance requirements.
 - 5. Accommodate building structure deflections in connections to structure.
- C. Fire Rated Assemblies: Comply with applicable code and tested according to ASTM E 119 and as scheduled in Drawings.
- D. 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.
- E. Non-Loadbearing Framing System Components: AISI S220 and ASTM C645, Section 10; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of limits listed above.

1. Protective Coating: AISI S220, ASTM A 653/A 653M, G40, (Z120); or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
 - a. Galvannealed products are unacceptable.
 2. Studs: C shaped with flat or formed webs.
 - a. Minimum Base-Steel Thickness: 0.0296 inch (20-gage drywall) unless otherwise indicated.
 - b. Minimum Base-Steel Thickness at Wall Tile: 0.033 inch.
 - c. Minimum Base-Steel Thickness at Opening Jambs: 0.033 inch.
 3. Runners: U shaped, sized to match studs.
 - a. Minimum Base-Steel Thickness: Same as studs.
 4. Equivalent Gauge Studs and Runners:
 - a. High strength, roll-formed and embossed with surface deformations to stiffen the framing members so they are structurally comparable to conventional ASTM C645 steel studs and tracks.
 - b. Minimum Base Steel Thickness: 0.0181 inch (20 EQ).
 - c. Prohibited Locations: High-strength (EQ) studs may not be used at the following locations:
 - 1) Walls at vestibules or other areas expected to be exposed to wind loads greater than 5 psf.
 - 2) Walls to receive tile or other inflexible finishes.
 - 3) Walls used to support countertop construction, casework, audio/visual equipment, or other similar elements.
 - 4) Walls greater than 15 feet in height.
 - d. Acceptable Product: ClarkDietrich; ProSTUD20 and ProTRAK20 with Smart Edge technology.
 5. Ceiling Carrying Channels: C shaped (Main Runners).
 - a. Minimum Base-Steel Thickness: 0.053 inch.
 - b. Minimum Depth: 1-1/2 inches.
 - c. Minimum flange width: 1/2 inch.
 6. Ceiling Furring Channels (Furring Members):
 - a. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - b. Steel Studs and Runners: 0.0296-inch minimum base-steel thickness.
 - c. Equivalent Gauge Studs and Runners: 0.0181 inch (20 EQ) minimum base-steel thickness.
 - 1) Acceptable Product: ClarkDietrich; ProSTUD20 and ProTRAK20 with Smart Edge technology.
 - d. Hat-Shaped, Rigid Furring Channels: 0.0296-inch minimum base-steel thickness, 7/8-inch deep.
 7. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
 - a. Minimum Base-Steel Thickness: 0.0296 inch.
 8. Cold-Rolled U-Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
 - a. Depth: 1-1/2 inches.
 9. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.018 inch, and depth required to fit insulation thickness indicated.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung, non-rated system unless otherwise noted, composed of main beams and cross-furring members that interlock.
1. Where fire-rated grid system may be required by authorities having jurisdiction provide hanger wire suspension 8-inches off fire breaks in accordance with system manufacturer's written guidelines.

2. Acceptable Products:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems (non-rated).
 - b. Chicago Metallic Corporation; Drywall Grid System (non-rated).
 - c. USG Corporation; Drywall Suspension System (non-rated).
- G. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- H. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- I. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- J. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.
 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- K. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
 1. Products:
 - a. ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com/#sle.
 - b. Fire Trak Corp.; Fire Trak System.
 - c. Metal-Lite, Inc; The System.
 - d. Slip Trak Systems; SLP-TRK.
 - e. Steel Network, Inc. (The); VertiTrack Series.
 - f. Substitutions: See Section 016000 - Product Requirements.
- L. Preformed Top Track Firestop Seal:
 1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems specified in Section 078400.
 2. Products:
 - a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
 - b. Specified Technologies Inc; SpeedFlex TTG Track Top Gasket: www.stfirestop.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- M. Non-Loadbearing Framing Accessories:
 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.
 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 4. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
 - a. Products:
 - 1) ClarkDietrich; Danback: www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.

5. Sheet Metal Backing: 0.0538 inch thick, galvanized.
 6. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
 7. Fasteners: ASTM C1002 self-piercing tapping screws.
 8. Anchorage Devices: Powder actuated.
 9. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- N. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 2. Tape Thickness: 1/4 inch.
 3. Products:
 - a. Armacell LLC; ArmaSound MTD: www.armacell.us/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- O. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs.
- P. Acoustic Insulation and Sealant: As specified in Section 092900 - Gypsum Board.
- Q. Isolation Strip at Exterior Walls: Provide one of the following:
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.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.
- C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.
- C. Examine areas and substrates for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- B. Coordination with Sprayed Fire-Resistive Materials:
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION OF STUD FRAMING

- A. Comply with requirements of ASTM C754.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install bracing at terminations in assemblies.
 - 1. For interior non-load bearing walls indicated to terminate above suspended ceilings provide 20-gauge stud diagonal bracing of walls at door openings, corner wall intersections and at maximum 10'-0" intervals to structural supports or substrates above. Otherwise extend framing full height to structural supports or substrates above suspended ceilings.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- E. Extend partition framing to structure where indicated and to ceiling in other locations.
- F. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- G. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- H. Align and secure top and bottom runners at 24 inches on center unless otherwise indicated.
- I. At partitions indicated with an acoustic rating:
 - 1. Install acoustic insulation, sealants, and accessories as described in Section 09 21 16.
 - 2. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
 - 3. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- J. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 1. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- K. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- L. Install studs vertically at spacing indicated on drawings unless otherwise required to meet performance requirements.
- M. Install studs so flanges within framing system point in same direction.
- N. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- O. Align stud web openings horizontally.
- P. Secure studs to tracks using crimping method. Do not weld.
- Q. Stud splicing is not permissible.
- R. Fabricate corners using a minimum of three studs.
- S. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
 - 1. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

- 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 in finished assembly.
- T. Brace stud framing system rigid.
- U. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.
- V. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- W. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.
- X. Use sheet metal backing/blocking for reinforcement of the following:
 - 1. Framed openings.
 - 2. Wall mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet accessories.
 - 5. Wall mounted door hardware.
 - 6. Wall mounted televisions or other equipment.

3.04 CEILING AND SOFFIT FRAMING

- A. Contractor's Option: At the Contractor's option suspended ceiling systems may be either suspended steel framing system or grid suspension system.
- B. Comply with requirements of ASTM C754.
- C. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- D. Install furring independent of walls, columns, and above-ceiling work.
- E. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated.
 - 1. Hanger spacing not to exceed 48 inches on center.
- F. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- G. Space main carrying channels at maximum 48 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- H. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- I. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

- J. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- K. Laterally brace suspension system.
- L. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- M. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- N. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.05 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

**SECTION 092900
GYPSUM BOARD**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Cementitious backing board.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- I. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units.
- J. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- N. ASTM E413 - Classification for Rating Sound Insulation.
- O. GA-216 - Application and Finishing of Gypsum Panel Products.
- P. GA-600 - Fire Resistance and Sound Control Design Manual.
- Q. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

- C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, joint finishing system, and acoustic insulation and sealants.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

1.06 QUALITY ASSURANCE

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

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- C. Protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Comply with requirements of ASTM C840 or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies tested according to ASTM E 119 and as scheduled in Drawings.
1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com.
 2. CertainTeed Corporation: www.certainteed.com.
 3. Georgia-Pacific Gypsum: www.gpgypsum.com.
 4. National Gypsum Company: www.nationalgypsum.com.
 5. USG Corporation: www.usg.com.
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
 - b. Mold resistant board is required in areas subject to wetting, steam, or high humidity.
 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

4. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch, unless otherwise noted.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
5. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
 - b. American Gypsum Company; FireBloc Type C Gypsum Wallboard: www.americangypsum.com/#sle.
 - c. CertainTeed Corporation; Type C Drywall: www.certainteed.com/#sle.
 - d. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
 - e. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
 - f. Georgia-Pacific Gypsum; ToughRock Fireguard C: www.gpgypsum.com/#sle.
 - g. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - h. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield C 5/8" Gypsum Board: www.goldbondbuilding.com/#sle.
 - i. USG Corporation; Sheetrock Firecode Type X.
 - j. USG Corporation; Sheetrock Firecode Type C.
 - k. USG Corporation; Sheetrock Ecosmart Type X
 - l. Substitutions: See Section 016000 - Product Requirements.
6. Mold-Resistant, Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
 - b. American Gypsum Company; M-Bloc Type C: www.americangypsum.com/#sle.
 - c. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
 - f. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - g. USG Corporation; Sheetrock Mold Tough Firecode Type X.
 - h. USG Corporation; Sheetrock Mold Tough Ecosmart Firecode Type X.
 - i. Substitutions: See Section 016000 - Product Requirements.
- C. Tile Backing Board:
 1. Application: Surfaces behind tile.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Products:
 - 1) Custom Building Products; Wonderboard Lite: www.custombuildingproducts.com.
 - 2) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
 - 3) USG Corporation; DUROCK Cement Board: www.usg.com.
 - 4) Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

- A. Sound Attenuation Insulation: ASTM C665; mineral fiber or glass fiber batt, friction fit type, unfaced, produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Thickness: As indicated on Drawings, minimum 2 inches.
 2. Fire-Rated Assemblies: Use insulation type required by indicated tested assembly.

- B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
 - 1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 2. Tape Thickness: 1/4 inch.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
 - c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
 - d. Pecora Corporation; AC-20 FTR.
 - e. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - f. Grabber Construction Products; Acoustical Sealant GSC.
 - g. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
 - h. USG Corporation; SHEETROCK Acoustical Sealant.
 - i. Substitutions: See Section 016000 - Product Requirements.
 - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Color of exposed acoustical joint sealants: Match adjacent surface.
- D. Acoustical Outlet Box Pads:
 - 1. Minimum thickness - 1/8 inch.
 - 2. Adhesion - adheres readily to metal or plastic.
 - 3. Service temperature - 30 degrees to 200 degrees F.
 - 4. Shall contain no asbestos.
 - 5. Minimum shelf life - 1 year.
 - 6. Non Fire Rated Products:
 - a. Lowry's Outlet Box Pads as manufactured by Harry A. Lowry & Associates, Inc., Sun Valley, CA.
 - b. Sound Pad #68 as manufactured by L.H. Dottie Co., City of Commerce, CA.
 - 7. Fire Rated Products:
 - a. Flamesafe FSP 1077 Putty Pads as manufactured by W.R. Grace & Co., Hartfield, PA.
 - b. Putty Pads as manufactured by Specified Technologies Inc., Somerville, NJ.
 - c. Hilti CP617 Putty Pads as manufactured by Hilti, Tulsa, OK.
 - d. 3M Fire Barrier Moldable Putty Pads type MPP-X to fit box size as manufactured by 3M, St. Paul, MN.
 - e. Metacaulk ® Putty Pads as manufactured by RectorSeal, Houston, TX.
- E. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, rigid plastic, or composite, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, LC-bead, and Casing Bead at exposed panel edges.
 - 3. Acceptable Products:
 - a. Same manufacturer as framing materials.
 - b. ClarkDietrich (Finishing Accessories) www.clarkdietrich.com
 - c. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 - d. Trim-tex, Inc: www.trim-tex.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.

- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Tape: 2 inch wide, coated glass fiber tape for joints and corners.
 - 2. Tape: 2 inch wide, creased paper tape for joints and corners for interior gypsum board.
 - 3. Tape for Tile Backing Panels: As recommended by panel manufacturer.
 - 4. Joint Compound: Drying type, vinyl-based, ready-mixed.
- G. Finishing Compound: Surface coat and primer, takes the place of skim coating.
- H. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- K. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- L. Anchorage to Substrate: Tie wire, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- M. Adhesive for Attachment to Metal:
 - 1. Products:
 - a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. General: Limit installation of outlet boxes and other penetrations to one penetration per stud bay. Seal all penetrations and gaps with acoustic sealant, outlet box pads, or other acoustic shielding materials as approved by Architect in accordance with manufacturer's written instructions and tested assembly instructions.
- B. Preparation for acoustic sealant:
 - 1. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 2. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
 - 3. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- C. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

- D. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.
- E. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- F. Acoustic Sealant: Install as follows:
 - 1. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
 - 2. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 3. Place one bead continuously on substrate before installation of perimeter framing members.
 - 4. Place continuous bead at perimeter of each layer of gypsum board.
 - 5. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.
- G. Acoustical Outlet Box Pads: Install as follows within acoustic partitions:
 - 1. Remove any water, excess dust, dirt and oil from the surfaces.
 - 2. Comply with manufacturer's written instructions and UL requirements.
 - 3. Ensure the entire surface is covered. Seal around conduit where it connects to outlet box using manufacturer's recommended materials.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- C. Form control and expansion joints with space between edges of adjoining gypsum panels.
- D. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- E. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- F. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- G. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- H. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- I. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.
- J. Installation on Metal Framing: Use screws for attachment of gypsum board.
- K. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

- L. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls to receive wallcoverings, and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.
- B. Repair damage from construction operations.

END OF SECTION

**SECTION 093000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for wall applications.
- B. Tile accessories, setting, and grouting materials.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 092900 - Gypsum Board: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).
- B. ASTM C499 - Standard Test Method for Facial Dimensions and Thickness of Flat, Rectangular Ceramic Wall and Floor Tile; 2009.
- C. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.
- D. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation.

1.04 DEFINITIONS

- A. DCOF: Dynamic Coefficient of Friction.
- B. Module Size: Actual tile size, with minor facial dimension as measured by ASTM C499, plus joint width indicated.
- C. Facial Dimension: Actual tile size, with minor facial dimension as measured by ASTM C499.
- D. Large Format Tile: Any tile unit that maintains an edge of 15 inches or greater in any dimension.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this Section; require attendance by all affected installers.
 - 1. Review installation procedures and coordination requirements.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Verification Samples:
 - 1. Full-sized units of each type and composition of tile and for each color and finish specified. For ceramic mosaic tile in color blend patterns, provide one full sheet of each specified color blend.
 - 2. Full-sized units of each type of trim and accessory for each color and finish specified.
 - 3. Grout color samples for each type and color specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Installer's Qualification Statement:
 - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Tile: 5 percent of each size, color, and surface finish combination.

1.07 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this Section, with minimum five years of documented experience.
- C. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.
 - a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
- D. Provide materials obtained from only one manufacturer for each type and color of tile, and for each type of mortar, grout, adhesive, and sealant.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Comply with referenced standards and manufacturer's recommendations for protection and maintenance of environmental conditions during and after installation.
- B. Do not install solvent-based products in an unventilated environment.
- C. Maintain ambient and substrate temperature of 50 degrees F during installation, and for at least seven days after installation. Maintain higher temperatures for proprietary mortars and grouts when recommended by manufacturer.
- D. Vent temporary heaters to the exterior to prevent damage to tile work due to carbon dioxide accumulation.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace materials that fail within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of 2 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Manufacturers and products specified on Drawings.

2.02 TILING MATERIALS

- A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- B. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.03 TRIM AND ACCESSORIES

- A. Metal Trim: Type and finish as indicated in drawings, style and dimensions to suit application, for setting using tile mortar or adhesive. Provide trim height to match tile and setting bed thickness.
 - 1. Acceptable Manufacturers:
 - a. Genesis APS International: www.genesis-aps.com/#sle.
 - b. Schluter-Systems; Schiene: www.schluter.com/#sle.
 - c. Ceramic Tool Company, Inc.
 - d. Futura Industries.
 - e. National Metal Shapes, Inc. Aluminum L-S Profiles.
 - f. Substitutions: See Section 016000 - Product Requirements.

2.04 SETTING MATERIALS

- A. Modified Dry Set Cement Mortar Bond Coat: ANSI A118.4 and ANSI A118.11.
 - 1. Applications: Use this type of bond coat where no other type of bond coat is indicated.
 - 2. Products:
 - a. ARDEX Engineered Cements; X 3+: www.ardexamericas.com/#sle.
 - b. Custom Building Products; MegaLite Crack Prevention Mortar, ProLite Tile & Stone Mortar, or Complete Contact Fortified Mortar : www.custombuildingproducts.com/#sle.
 - c. H.B. Fuller Construction Products, Inc; TEC Ultimate Large Tile Mortar or Ultimate 6 Plus Mortar: www.tecspecialty.com/#sle.
 - d. LATICRETE International, Inc; 4-XLT: www.laticrete.com/#sle.
 - e. Mapei Corporation; Ultralite or Ultracontact: www.mapei.com.
 - f. Substitutions: See Section 016000 - Product Requirements.

2.05 GROUTS

- A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
 - 4. Acceptable Products:
 - a. ARDEX Engineered Cements; ARDEX FL (Sanded) or FGC (Unsanded) : www.ardexamericas.com/#sle.
 - b. Custom Building Products; Prism Color Consistent Grout : www.custombuildingproducts.com/#sle.
 - c. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
 - d. LATICRETE International, Inc.; LATICRETE PermaColor: www.laticrete.com.
 - e. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
 - f. Substitutions: See Section 016000 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Backing Board: Specified in Section 092900 - Gypsum Board.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.

- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Blending: For tile exhibiting color or pattern variations within the ranges of accepted submittals, verify that tile has been blended in the packages so that tile units taken from one package show same range in colors or patterns as those taken from other packages. If not blended in the packages, blend tile in the field before installation.
- B. Wall System Coverage: Where specified for individual setting methods, install wall tile units with 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile units in referenced ANSI A108 specifications.
- C. Movement Joints: Comply with TCNA (HB) Method EJ171F requirements for locations, spacing, and installation of applicable movement joints, whether or not specifically indicated or detailed on Drawings, and as follows:
 - 1. Joint Width: Match adjacent grouted joint widths, unless TCNA EJ171 requires a specific joint width based on joint location or joint service conditions.
 - 2. Apply sealant joint to junction of tile and dissimilar materials and junction of dissimilar planes, including but not limited to floor to wall joints, corners, and metal trim and non-ceramic accessory items.
 - 3. Keep movement joints free of setting adhesive and grout.
 - 4. Where metal trims are not specified, form internal angles and corners square, not grouted, with sealant joint.
 - 5. Where metal trims are not specified, form external angles and corners square, not grouted, with sealant joint.
 - 6. Apply specified sealant to joints.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints, except where movement joints are indicated or specified.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- L. Allow completed tiling assemblies to cure full 72 hours before allowing heavy foot or equipment traffic on final installations.

3.04 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244 .
 - 1. Provide 100 percent coverage of setting mortar over tile back surfaces.

3.05 TOLERANCES

- A. Comply with applicable requirements of ANSI A108.2, unless otherwise specified in this Section .
- B. Flatness - Finished Tiling Surfaces:
 - 1. Ceramic Tile: 1/4 inch in 10 feet.
- C. Lippage - Adjacent Tile Units:

1. Glazed Wall Tile and Mosaic Tile: 1/32 inch; joint width 1/16 inch to 1/8 inch; 1 x 1 inch to 6 x 6 inch tile size.

3.06 CLEANING

- A. Clean tile and grout surfaces.
- B. Remove grout efflorescence as required with product approved by tile and grout manufacturer.
- C. Unglazed tile may be cleaned with sulfamic acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after completion of installation. Protect metal surfaces, iron, and vitreous fixtures from effects of acid cleaning. Flush surfaces with clean water before and after acid cleaning.
- D. Leave finished installation clean and free of cracked, chipped, broken, un-bonded, or otherwise defective tile work.

END OF SECTION

SECTION 095113
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels: Access panels.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
 - 1. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples minimum 6 x 6 inch in size illustrating material and finish of acoustical units.
- D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.
- C. System Installer Qualifications: Company specializing in the installation of products specified in this Section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 20 to 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:

1. As scheduled.
- B. Other Acceptable Manufacturers - Acoustic Panels:
 1. Armstrong World Industries, Inc.: www.armstrong.com.
 2. CertainTeed Corporation: www.certainteed.com/#sle.
 3. Rockfon, LLC: www.rockfon.com.
 4. USG Corporation: www.usg.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- C. Acceptable Manufacturers - Suspension Systems:
 1. Same as for acoustical units.

2.02 PERFORMANCE REQUIREMENTS

- A. Interior Suspended Ceilings, Soffits, and Bulkheads: Maintain deflection of not more than L/360 of distance between supports.
- B. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.03 ACOUSTICAL CEILINGS

- A. Acoustical Units - General: ASTM E1264, Class A.
 1. Provide units with manufacturer's proprietary anti-humidity, sag-resistant composition and anti-microbial treatment to inhibit the propagation of mold and mildew.

2.04 SUSPENSION SYSTEMS

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, except provide not less than G60 coating for severe or wet environments.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid.
 1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 2. Profile: Tee; 15/16 inch face width.
 3. Finish: Baked enamel.
 4. Color: White, unless otherwise indicated.

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 1. Size: As required for installation conditions.
 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 3. At Circular Penetrations: Provide edge moldings fabricated to diameter required to fit penetration precisely.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

- C. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges; finish cut edges to match factory finished edges if cut edge is exposed to view.
 - 3. Double cut and field paint exposed reveal edges to match factory finished edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips on panels within 10 ft of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. 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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

**SECTION 096500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results For Flooring Preparation: Independent agency testing of concrete slabs, cleaning, or preparation.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.
- C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, minimum 6 x 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: Additional quantity equivalent to 2 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Deliver and store materials in manufacturer's original unopened containers, with brand names and production lot numbers clearly marked.
- E. Protect roll materials from damage by storing on end.
- F. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a minimum temperature of 65 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.
- B. Install resilient flooring and accessories after other finishing operations, including painting have been completed.
- C. Do not install resilient flooring over concrete slabs until slabs have been fully cured, and are sufficiently dry to achieve proper bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

1.08 WARRANTY

- A. Resilient Flooring: Provide manufacturer's warranty, as follows:
 - 1. Materials: Minimum 15 years from date of purchase, covering manufacturing defects and wear due to normal foot traffic.
 - 2. Installation: Minimum 2 years from date of installation; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Manufacturers and products specified on Drawings.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TILE FLOORING

- A. Luxury Vinyl Tile:
 - 1. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648, NFPA 253, ASTM E648, or NFPA 253.
 - 3. Plank Tile Size: 9 by 36 inch.
 - 4. Wear Layer Thickness: 0.032 inch.
 - 5. Total Thickness: 0.120 inch.
 - 6. Types and Colors: As indicated on drawings.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesives: Waterproof; types recommended by flooring manufacturer.
 - 1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- C. Resilient Wall Base, Edge Strips, and Accessories: Specified in Section 096513.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Minimum F(F) Floor Flatness Values:
 - 1. Under Resilient Flooring: F(F) of 35.
- C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 090561.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
3. If flooring manufacturer does not recommend specific remediation materials and procedures, follow moisture and alkalinity remediation procedures in Section 090561.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 090561.
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 1. Spread only enough adhesive to permit installation of materials before initial set.
 2. Fit joints and butt seams tightly.
 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 1. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Install flooring in pattern as indicated in drawings. Allow minimum 1/2 full size tile width at room or area perimeter.
- C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.
- B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION

SECTION 096513
RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient wall base.
- B. Resilient edge and transition strips.
- C. Flooring system accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: If basis of design color is not provided, submit manufacturer's complete set of color samples for Architect's selection.
- D. Verification Samples: Submit two samples, minimum 4x4 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Base: 24 linear feet of each type and color.
 - 3. Clearly identify each package.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Deliver and store materials in manufacturer's original unopened containers, with brand names and production lot numbers clearly marked.
- E. Protect roll materials from damage by storing on end.
- F. Do not double stack pallets.

1.06 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a minimum temperature of 65 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.
- B. Install resilient accessories after other finishing operations, including painting have been completed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturers:

1. Manufacturers and products specified on Drawings.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RESILIENT BASE

- A. General: Comply with adhesives and sealants and flooring system product requirements specified.
- B. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set, Style B, Cove.
 1. Acceptable Manufacturers:
 - a. Mannington Commercial: www.manningtoncommercial.com.
 - b. Johnsonite, a Tarkett Company: www.commercial.tarkett.com
 - c. Roppe Corp.: www.roppe.com.
 - d. ShawContract: www.shawcontract.com.
 - e. Substitutions: See Section 016000 - Product Requirements.
 2. Group: I (solid, homogeneous).
 3. Height: 4 inch.
 4. Thickness: 0.125 inch.
 5. Finish: Satin.
 6. Color: As indicated on drawings.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesives: Waterproof; types recommended by flooring manufacturer.
 1. Compatible with materials being adhered; maximum VOC content of 50 g/L.
- C. Moldings and Edge Strips: Homogeneous vinyl or rubber type; tapered or bullnose edge; one inch wide; color selected by Architect.
- D. Moldings, Transition and Edge Strips: As scheduled in drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

- A. Prepare substrates as recommended by flooring and adhesive manufacturers.
- B. Remove substrate ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
 1. Prohibit traffic until filler is fully cured.
- C. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 1. Spread only enough adhesive to permit installation of materials before initial set.
 2. Fit joints and butt seams tightly.

3.04 INSTALLATION - RESILIENT BASE

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Fit joints tightly and make vertical. Install in longest lengths possible; maintain minimum dimension of 18 inches between joints.

- C. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
- D. Install base on solid backing. Bond tightly to wall and floor surfaces.
- E. Do not stretch wall base during installation.
- F. Scribe and fit to door frames and other interruptions.

3.05 INSTALLATION - RESILIENT ACCESORIES

- A. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Type and Location: As indicated in Drawings.
 - 2. Resilient Strips: Attach to substrate using adhesive.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 096700
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
- B. Section 090561 - Common Work Results For Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 DEFINITIONS

- A. DCOF: Dynamic Coefficient of Friction.
- B. Slip-Resistant: Installed flooring surface which has a wet coefficient of friction of 0.42, minimum, as measured according to ANSI B101.3 (DCOF Slip Resistance Test).

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this Section; require attendance by all affected installers, manufacturer, Contractor, and Architect.
 - 1. Discuss installation testing, prep, procedures, details, and other pertinent issues.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples for Selection: Submit samples showing range of options for color, texture, and aggregate for each system.
- D. Samples for Verification: Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Manufacturer's Certificate: Provide letter of certification from manufacturer stating that installer is a certified applicator and is familiar with manufacturers required procedures for application of specified finish system
 - 1. Slip-Resistance: Certify that specified floor finish system, when installed, comply with specified requirements for slip-resistance.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Manufacturer's Qualification Statement.
- I. Applicator's Qualification Statement.
- J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

- B. Applicator Qualifications: Company specializing in performing the work of this Section.
 - 1. Minimum five years of documented experience.
 - 2. Approved by manufacturer.
- C. Basis of Design: Specifications are based on flooring types by the specified basis of design manufacturer. Flooring types manufactured by other acceptable manufacturers are permitted, subject to compliance with all specified requirements; and provided that deviations in composition, construction, performance, and finish are minor and do not detract substantially from the indicated design intent.

1.08 MOCK-UP

- A. Construct mock-up or field sample panel of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One.
 - 2. Use same materials and methods for use in the work.
 - 3. Locate where directed.
 - 4. Minimum Size: 48 inches by 48 inches.
- B. Obtain approval of mock-up by Architect and Owner before proceeding with work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store resin materials in a dry, secure area.
- C. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.10 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.
- D. Concrete substrate shall be properly cured for a minimum of 28 days.

1.11 WARRANTY

- A. Fluid-applied Flooring: Provide manufacturer's warranty, as follows:
 - 1. Materials: Minimum 2 years from Date of Substantial Completion.
 - 2. Installation: Minimum 2 years from Date of Substantial Completion; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer:
 - 1. Dur-A-Flex; Poly-Crete SLB: www.dur-a-flex.com/.
- B. Other Acceptable Manufacturers:
 - 1. Key Resin Company: www.keyresin.com.
 - 2. PPG Paints Megaseal Fluid Applied Flooring: www.ppgpaints.com/#sle and www.ppgpmc.com/home.aspx/#sle.
 - 3. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com.
 - 4. Tnemec Company, Inc.: www.tnemec.com.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 FLOORING APPLICATIONS - GENERAL

- A. Slip-Resistance: Installed flooring must be slip resistant.

2.03 FLOORING MATERIALS

- A. Fluid-Applied Flooring: Cementitious urethane base coat with aggregate and topcoat.
 - 1. Aggregate: Quartz granules.
 - 2. System Thickness: 3/16 inch, nominal, when dry.
 - 3. Texture: Slip resistant.
 - 4. Basis of Design System:
 - a. Primer: As recommended by manufacturer.
 - b. Base Coat:
 - 1) Material Design Basis: POLY-CRETE SLB
 - 2) Formulation Description: 100 percent solids.
 - c. Pigment and topcoat:
 - 1) As indicated in Drawings.

2.04 ACCESSORIES

- A. Base Caps: Zinc or plastic with projecting base of 1/8 inch; color as selected.
- B. Cant Strips: Molded material compatible with flooring.
- C. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- D. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 090561.
 - 2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R.
- C. Prepare concrete surfaces according to manufacturer's guidelines.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- E. Vacuum clean substrate.
- F. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

- A. Install cant strips at base of walls where flooring is to be extended up wall as base.
- B. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and top coating of cove base. Round internal and external corners.
- C. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer to surfaces required by flooring manufacturer at manufacturer's recommended rate.
- C. Apply each coat to minimum thickness required by manufacturer.
 - 1. Mix and apply mortar and base coat(s) as indicated for flooring system and at coverage rates recommended in writing by manufacturer. Screed mortar materials, compact and smooth, with steel finishing trowels.
 - 2. Aggregate: Broadcast in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer
 - 3. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- D. Finish to uniform, level surface.

3.05 TERMINATIONS

- A. Chase edges to "lock" the coating system into the concrete substrate along lines of termination.
- B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- C. Treat floor drains by chasing the coating to lock in place at point of termination.

3.06 JOINTS AND CRACKS

- A. Treat control joints to bridge potential cracks and to maintain monolithic protection.
- B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.07 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION

**SECTION 097200
WALL COVERINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on wall covering and adhesive.
- C. Shop Drawings: Indicate wall elevations with seaming layout.
- D. Samples: Submit two samples of wall covering, 24 x 24 inch in size illustrating color, finish, and texture.
- E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.
 - 3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this Section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages or containers clearly labeled to identify manufacturer, brand name, quality and grade, and fire hazard classification.
- B. Inspect roll materials at arrival on site, to verify acceptability.
- C. Protect packaged adhesive from temperature cycling and cold temperatures.
- D. Store materials in a well ventilated area protected from weather, moisture, soiling, and extreme temperatures and humidity. Maintain temperature in storage area above 40 degrees F.
- E. Protect packaged adhesive from temperature cycling and cold temperatures.
- F. Do not store roll goods on end.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.
- B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 WALL COVERINGS

- A. General Requirements:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.
- B. Vinyl Wall Covering: Fabric-backed vinyl roll stock; Type II.
 - 1. Color: As indicated in drawings.
 - 2. Product: MDC Balancing Act.
- C. Vinyl Wall Protection: Vinyl with a protective coating and woven backing.
 - 1. Abrasion Resistance : ASTM D-4977 Level 3
 - 2. Impact Resistance : ASTM D-5420 Level 2.
 - 3. Color: Color: As indicated in drawings.
 - 4. Product: Koroseal Flex Thatch.
- D. Architectural Film Interior Surfacing: Architectural overlay with pressure sensitive adhesive backing.
 - 1. Description: Precision manufactured from blend of synthetic, engineered plastics, produced using calendaring process. and printed using high-definition presses.
 - 2. Thickness: Maximum 6 mils without adhesive layer, 8.5 mils with adhesive layer.
 - 3. Fire hazard classification: Class A, tested to ASTM E84 and UL 723.
 - 4. Color: As indicated in drawings.
 - 5. Product: Koroseal REATEC.
- E. Custom Printed Logo: Vinyl wallcovering.
 - 1. Graphic: As provided by Owner.
 - 2. Product: 3M ControItac with 3M Scotchcal Matte Graphic Protection Overlamine.
- F. Adhesive: Water based type, zero (0) VOC content, spray application.
 - 1. Acceptable Product: As recommended by manufacturer.
- G. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- H. Substrate Primer and Sealer: Free of volatile organic compounds (VOC); wall covering manufacturer's recommended or approved type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

- A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this Section. Remove existing coatings that exhibit loose surface defects.
- E. Marks: Seal with shellac those that may bleed through surface finishes.
- F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

- A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
- B. Apply adhesive to wall surface immediately prior to application of wall covering.
- C. Use wall covering in roll number sequence.
- D. Razor trim edges. Do not razor cut on gypsum board surfaces.
- E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
- F. Butt edges tightly.
- G. Horizontal seams are not acceptable.
- H. Do not seam within 2 inches of internal corners or within 6 inches of external corners.
- I. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.
- J. Do not install wall covering more than 1/4 inch below top of resilient base.
- K. Cover spaces above and below windows, above doors, in pattern sequence from roll.
- L. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this Section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

**SECTION 099123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
 - 10. Glass.
 - 11. Acoustical materials, unless specifically indicated.
 - 12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Shop-primed items.
- B. Section 099113 - Exterior Painting.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. Cross-reference to specified paint system products to be used in project; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals, wood cabinets, and wood doors, have been approved.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.
 2. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.
 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Ceiling Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and plaster (Flat).
 1. Two top coats and one coat primer.
 2. Top Coat(s): Interior Latex.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
 3. Primer: Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer.
- B. Interior Wall Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and plaster (Eg-shel).
 1. Two top coats and one coat primer.
 2. Top Coat(s): High Performance Architectural Interior Latex.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel, B20-2600 Series.
 3. Primer: Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
- C. Interior Wall Surfaces to be Painted, Unless Otherwise Indicated: Including CMU (Eg-shel).
 1. Two top coats and one coat primer.
 2. Top Coat(s): High Performance Architectural Interior Latex.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel, B20-2600 Series.
 3. Primer: Sherwin Williams Sherwin-Williams Loxon Block Surfacers.
- D. Interior Wall or Ceiling Surfaces to be Epoxy Painted, Unless Otherwise Indicated: Including gypsum board and plaster (Semi-).
 1. Two top coats and one coat primer.
 2. Top Coat(s): Waterbased
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Catalyzed Waterbased Epoxy, B73-300 & 360 Series.
 - b. Primer: Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer, B28W12600.
- E. Wood Wall Protection, Doors, and Trim to be Painted, Unless Otherwise Indicated: Including wood and shop primed steel (Semi-Gloss).
 1. Two top coats and one coat primer.
 2. Top Coat(s): Waterbased Alkyd Urethane Enamel.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, Semi-gloss, B53-1150 Series.
 3. Primer: Wood.
 - a. Sherwin Williams Premium Wall and Wood Primer, B28W8111.
 4. Primer: New steel and ferrous metals.
 - a. Sherwin Williams Pro Industrial Pro-Cryl Universal primer, B66-1310 Series
- F. Paint I-OP-MD-WC - Medium Duty, Vertical: Including gypsum board substrates.

1. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - a. Products:
 - 1) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss. (MPI#115)

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Sand existing painted surfaces as necessary.
- E. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- F. Seal surfaces that might cause bleed through or staining of topcoat.
- G. Masonry:
 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- J. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- K. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 102600
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards and end guards.

1.02 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Product Data: Indicate physical dimensions and anchorage details.
- B. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 12 inches long.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- D. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers - Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Construction Specialties, Inc.: www.c-sgroup.com/#sle.
 - 3. Inpro: www.inprocorp.com/#sle.
 - 4. Koroseal Interior Products: www.koroseal.com/#sle.
 - 5. Nystrom, Inc.: www.nystrom.com/#sle.
 - 6. Trim-Tex, Inc.: www.trim-tex.com/#sle.
 - 7. Substitutions: See Section 016000 - Product Requirements.

2.02 PRODUCT TYPES

- A. Stainless Corner and Edge/Wall Guards - Surface Mounted.
 - 1. Material: Type 304 stainless steel, No. 4 finish, minimum 16 gauge thick.
 - 2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 3. Width of Wings: 1 1/2 inches.
 - 4. Corner: Square.
 - 5. Length: One piece.
 - 6. Basis of Design: Koroseal Interior Products; GS15: www.koroseal.com/#sle.
- B. Mounting: Manufacturer's recommended tape or adhesive.

2.03 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as instructed by the manufacturer.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

**SECTION 114000
KITCHEN EQUIPMENT**

PART 1 – GENERAL

1.01 SCOPE

- A. Include the work specified, shown or reasonably inferred as part of the foodservice equipment. Portions of the work may be subcontracted to those qualified to do the work as required by jurisdictional trade agreements and restrictions.
- B. Kitchen equipment furnished and installed by the Foodservice Contractor In the base bid.
- C. Provide itemized pricing providing both each pricing and total pricing for every item specified with a bid grand total.

1.02 RELATED SECTIONS

- A. Division 15 – Mechanical rough-ins, inter-connections of the equipment as required and final connections.
- B. Division 16 – Electrical rough-ins, inter-connections of the equipment as required and final connections.

1.03 QUALITY ASSURANCE

- A. All equipment and associated work must comply with all applicable laws, statutes, building codes and regulations of public authorities and comply with the following:
 - a. NSF (National Sanitation Foundation). All the equipment must bear the NSF label.
 - b. NEC (National electric Code).
 - c. UL (Underwriter's Laboratories, Inc.).
 - d. AGA (American Gas Association Laboratories).
 - e. NFPA (National Fire Protection Association).
- B. The following are approved fabricators for providing the fabricated food service equipment:

Jero Manufacturing, Inc.
5117 South 100th East Avenue
Tulsa, Oklahoma 74115

Stainless Innovations
1110 Carnall
Fort Smith, Arkansas 72901

1.04 SUBSTITUTIONS

- A. Equipment items and the components specified are intended to be the basis of the bid. All other manufactures, including manufactures which may be listed as "alternates" or "approved equals" must conform with the specifications, size, accessories, etc. of the original manufacture specified.
- B. Proposed substitutions will be substituted no later then fourteen (14) days prior to the bid date. Submit the proposed substitutions with the manufactures specification or catalog sheets, shop drawings, etc. indicating all modifications required to conform to the specified items.

- C. Approved substitutions will be addressed in an addendum(s). Approved substitutions will be noted on the bid form as a substitution. All costs and fees for any design and engineering services required to make adjustments to the space, systems, utilities, etc. will be the responsibility of the successful bidder. All costs incurred for modifications of the utilities or construction or professional services will be the responsibility of the successful bidder.
- D. The Owner reserves the right to accept or reject any or all of the substitutions proposed before the execution of the contract.

1.05 DOCUMENT INTERPERTATION

- A. An addendum(s) will be issued addressing questions and comments from contractors, suppliers or vendors pertaining to the intent or clarity of the construction documents.
- B. All questions and comments will be submitted in writing by the contractors, suppliers and vendors for review.

1.06 SUBMITTALS

- A. Submit brochure books, rough-in drawings, fabrication shop drawings and manufactures shop drawings. Refer to the general specifications for the required quantities.
 - a. Brochures:
 - 01 Provide with a front and rear cover. Label the front cover with the project name.
 - 02 Provide a cover sheet for each item number. The cover sheet will indicate the item number, the item name, the quantity, the manufacture, all optional equipment and accessories, specified modifications, the utility requirements and any special instructions.
 - 03 The manufactures catalog specification sheets.
 - b. Submittal drawings:
 - 01 Indicate all equipment shown on the contract documents drawn at a 1/4" scale.
 - 02 The contract documents are not to be traced or reproduced.
 - 03 Provide an equipment schedule indicating all the equipment shown on the contract documents.
 - 04 Drawings to be submitted on the same size drawing sheet as the Contract Documents in a PDF format. Provide the necessary required hard copies of the reviewed/stamped document to the General Contractor. Submit the drawings separately from the Brochure Book.
 - c. Rough-in drawings:
 - 01 Indicate all equipment shown on the contract documents drawn at a 1/4" scale.
 - 02 indicate all general use and convenience utilities indicated on the contract documents.
 - 03 Include utilities shown on the contract documents but connected to equipment not furnished in this section.
 - 04 Fully dimension all the utilities for the plumbing, electrical and mechanical from the finished room surface to the point of the stub-up through the floor and the stub-out through the wall or ceiling.
 - 05 Drawings to be submitted on the same size drawing sheet as the Contract Documents in a PDF format. Provide the necessary required hard copies of the reviewed/stamped document to the General Contractor. Submit the drawings separately from the Brochure Book.
 - d. Manufacture's and fabricators shop drawings:

- 01 Indicate all equipment shown on the contract documents drawn at a 3/4" scale for the plan views and elevations. All sections and details to be drawn at a minimum of 1 1/2" scale.
- 02 Include the equipment name, the item number and the quantity on the drawings.
- 03 Include all required and necessary sections, details and elevations to reflect the drawings and the specifications.
- 04 Indicate all adjacent equipment, walls and columns.
- 05 Include all necessary plumbing and electrical schematic drawings.
- 06 Include any ventilation or access panels as required by the manufactures of the built-in equipment.
- 07 Drawings to be submitted on the same size drawing sheet as the Contract Documents in a PDF format. Provide the necessary required hard copies of the reviewed/stamped document to the General Contractor. Submit the drawings separately from the Brochure Book.

1.07 COORDINATION OF THE PROJECT AND DATA

- A. Review the contract documents, rough-in drawings, shop drawings and brochure books for accuracy and completeness.
 - a. Notify the Architect of any conflicts and required adjustments in writing.
 - b. Coordinate the work with this section with the other sub-contractors on the job.
 - c. Submit paint, stain, plastic laminate, vinyl coated surfaces, molded plastic, natural stone, man-made stone and solid surface material to the Owner for approval.
 - d. Obtain serviceware samples for sizing and weight information from the Owner for coordination of all self-leveling equipment.
 - e. Coordinate all mobile equipment will go through doors, wall openings and roll-in/roll-thru equipment. Notify the Architect of all conflicts or deviations from the approved submittals in writing.

1.08 FIELD VERIFICATION OF THE PROJECT AND DATA

- A. Review the contract documents, rough-in drawings, shop drawings and brochure books for accuracy and completeness.
 - a. Field verify all the under-slab rough-in locations and quantities before the concrete slab is poured. Notify the Architect in writing of all conflicts or omissions of the rough-ins.
 - b. Field verify all the in-slab recess locations, sizes, depths and quantities before the concrete slab is poured. Notify the Architect in writing of all conflicts or omissions of the in-slab recess.
 - c. Field verify all the in-wall rough-in locations and quantities before the drywall is installed. Notify the Architect in writing of all conflicts or omissions of the rough-ins.
 - d. Obtain actual field dimensions or guaranteed measurements from the general contractor to insure the proper fit of the equipment at the job site. The dimensions shown in the contract documents are approximate. The dimensions are for the bidding process only.
 - e. Field check all dimensions, measurements job site conditions before the fabrication and/or delivery of equipment to the job site. Notify the Architect of all conflicts or deviations from the approved submittals in writing.
 - f. Coordinate any exterior wall openings required for the delivery of all oversized equipment with the general contractor. The equipment must be manufactured to fit through standard door openings if this cannot be done.

1.09 WARRANTY

- A. Provide manufacture's warranty on each piece of specified equipment.

- B. The warranty period will be for one year after acceptance from the Owner for parts and labor.
- C. The warranty period will be for five years after acceptance from the Owner for compressor bodies for refrigeration equipment.
- D. The warranty period will be for ten years after acceptance from the Owner for the walk-in panels.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Stainless steel.
 - a. All stainless steel to 18-8, type 304, polished to a 180 grit number 4 finish unless noted otherwise in the item specifications or in the drawings.
 - b. All seams and joints are to be heli-arc welded completely and free of flaws and pits. Grind the welds smooth and polish to a number 4 finish.
 - c. The grain of the stainless steel is to run the length of the equipment including the backsplash. Provide a polished miter look where the tops form a corner.
- B. Galvanized iron.
 - a. All seams and joints are to be heli-arc welded completely and free of flaws and pits. Grind the welds.
 - b. Thoroughly clean the welded and polished areas and prime and paint with Rustoleum in a color to match the metal.
- C. Sound deadening.
 - a. Apply 1/2" wide Schnee Butyl sealant rope continuously between all bracing/frame members and the underside of the table/counter tops, overshelves, wall shelves and undershelves.
 - b. Weld stud bolts to the underside of the tops, overshelves, wall shelves and undershelves. Tighten the stud bolts for maximum compression of the sound deadening. Trim any excess that extends from out of the bracing.
- D. Shop and field joints.
 - a. Field joints are to be used only when the equipment size must be limited for access into the building.
 - b. Indicate the field joint locations on the shop drawings.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify and test that all equipment is plumbed, wired correctly, true and in good working order. Do not use until turned over to the Owner.
- B. Protect all appliances from construction dirt until the project is turned over to the Owner.

3.02 DELIVERY

- A. Coordinate with the construction progress and the Owner's operation schedule. Unless otherwise instructed by the general contractor or the Owner, the following procedures apply.

- a. Items that integrate into the building, such as, walk-in coolers and freezers, ventilators, hoods, equipment supports, ceiling mounted utensil racks, etc. will be sent to the job site after the building is water tight and directed by the general contractor. Protect the equipment as required after installation is complete.
- b. All the additional fixed equipment and mobile equipment requiring plumbing and electrical final connections will be delivered to the job site after the completion of the finished floor, wall finish, ceiling grid and tile or drywall and paint and the lighting system.
- c. The remaining mobile equipment will be delivered to the job site after the equipment can be inventoried and secured in a lockable area. If a secured area is not available, deliver the equipment when the job site when the installation is completed and the equipment clean-up process have been completed.
- d. Small counter item, pans, flatware containers, etc. will be delivered only when the Owner is ready to receive and inventory the items.

3.03 INSTALLATION

- A. Provide a competent supervisor at the job site during the entire installation process.
- B. Install the equipment per the manufacture's recommendations. Install the equipment square and level. All equipment shall be ready for the final connections.
- C. Protect the equipment after the installation process is complete.
 - a. Protect the custom fabricated equipment with fiberboard or plywood taped to the tops and exposed body surfaces.
 - b. Protect the buy-out equipment with fiberboard or plywood taped to the tops and exposed body surfaces.
 - c. The general contractor must insure the equipment is not used by other sub-contractors as work tables, scaffolding, tool and material storage, etc.
- D. Provide and install 18 gauge stainless steel trim at all gaps between the equipment and the walls and/or other high equipment when the gap is larger than 7/16 of an inch wide. Turn the trim down 90 degrees at the equipment splashes, top and/or turn downs. Attach the trim with hidden fasteners and seal with silicone caulking.

3.04 CLEAN AND ADJUST

- A. Leave the work area clean and free of debris.
- B. Remove or replace panels, parts or frames that are bowed, warped, dented or scratched as a result of manufacturing defects, shipping and delivery to the job site.
- C. The Foodservice Contractor is to deliver the foodservice equipment to the job sits, uncrate the equipment, remove all packing materials from the equipment, set the equipment into place per the floor plan and the job site conditions, level the equipment and make ready for final connection by the Mechanical, Plumbing and/or Electrical Contractor. All crating materials are to be removed from the job site by the Foodservice Contractor.
- D. The Foodservice Contractor will final clean (not sanitizing) the foodservice equipment and seal the fixed foodservice equipment to the adjacent walls and/or fixed equipment with silicone caulking after all the utilities have been connected. The caulking will be neat, smooth and level with the foodservice equipment. Concaved caulking will be rejected. Remove any smeared caulking from the foodservice equipment and adjacent surfaces.

3.05 SERVICE MANUAL

- A. Provide manufacture's warranties and operating manuals on all appliances over to the Owner.
- B. Each appliance shall have operating instructions and maintenance information.
- C. The Foodservice Contractor will furnish to the Owner three (3) copies of an owner's and operations manual. The manual will be in three ring binders. The manuals will include a cover sheet for each equipment item, warranty information sheets, manufactures specification sheets and the service agent's name, address and telephone number.
- D. All warranties are not to begin until after the Owner accepts successful completion of the Start-up Demonstration and the kitchen.

3.06 EQUIPMENT DEMO AND START UP

- A. The Foodservice Contractor must test, adjust and regulate all the equipment per the manufacturer's instructions.
- B. The Foodservice Contractor will schedule, at the Owner's convenience, a date and time to demonstrate the foodservice equipment to the Owner. The Foodservice Contractor will start up and check out the foodservice equipment before the equipment is demonstrated to the Owner.

PART 4 – EQUIPMENT

ITEM NO. 01 - WALK-IN COOLER & FREEZER (1 REQUIRED)

The walk-in cooler & freezer to be manufactured by Thermo-Kool. The walk-in cooler & freezer to be 26'-9 1/2" x 7'-9 1/2" x 8'-3" high per the drawings and proposal number Q44100-55. Provide a 4" thick insulated panel floor. Provide stucco aluminum on the exterior and interior of the unit and white stucco aluminum on the ceiling.

Features

- 01 Provide two (2) hinges on the doors.
- 02 Two (2) vapor proof lights.
- 03 Foot treadle at the doors.
- 04 One (1) 14" x 24" heated peep window in each door.
- 05 Two (2) pressure relief vents.
- 06 EC motors on the evaporator coils.
- 07 Provide wall trim and a closure panel constructed of stucco aluminum.
- 08 Provide all necessary refrigeration lines (hard copper), refrigerant and labor from the evaporator to the refrigeration rack system located on the ground.
- 09 All refrigerant line runs to be on the exterior of the walk-in with short runs only from the evaporators to above the ceiling. Seal the holes for the lines with a spray foam insulation to make an air-tight seal. Provide stainless steel or chrome covers at all exposed penetrations.
- 10 14 Gauge fully welded stainless steel bumper rails pre drawings and details on the exposed exterior walls and doors.
- 11 Provide 14 Gauge fully welded stainless steel trim pre drawings and details around the opening in the building and the walk-in box.

Accessories

- 1 ea. ColdZone model MPL-2 refrigerated rack system per proposal number 24-0930. Locate the rack on the building roof. Verify the location at the job site.
- 1 ea. 208 volts, three phase.
- 2 ea. Berner model ASD36078 swing door. Install per the Manufactures requirements with stainless steel screws.

- 4 ea. 48" LED light fixtures with bulbs as located per the drawings. Conduit shall not be run on the interior of the units except what is required to connect to the lights. Seal the holes for the conduit and inside the conduit with a spray foam insulation to make an air-tight seal.

ITEM NO. 02 - WALK-IN SHELVING - EXISTING

ITEM NO. 03 - MOBILE DUNNAGE RACKS - EXISTING

ITEM NO. 04 - MOBILE UTILITY CART (4 REQUIRED)

Lakeside Manufacturing model 422 with all the standard features.

ITEM NO. 05 - MOBILE COOLING RACKS (6 REQUIRED)

New Age model 1306 with all the standard features.

Accessories

- 6 sets. Provide with polyurethane tired casters with brakes.
6 ea. Model PB - Perimeter bumpers.

ITEM NO. 06 - MOBILE PAN RACK (4 REQUIRED)

Eagle Group Model QUADPLUS mobile pan rack. Provide each unit four (4) shelves with 74" high posts. Mount the bottom shelf at 10" above the finish floor. Mount the remaining shelves at 17" on center.

Accessories

- 16 ea. Model QPF-2436E-GL shelves.
16 ea. Model CP74-E posts.
16 ea. Model CSB5P-300 casters with brakes.

ITEM NO. 07 - PREP TABLE (1 REQUIRED)

Custom fabricated prep table to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 01 Provide with a 10" high x 2" thick backsplash at the rear and high equipment. Attach the back splash to the wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Extend splash at pre-rinse faucet per drawings. Extend counter bracing up to top of extension. Fully weld bracing to counter bracing. Provide with a removable finished back where exposed.
- 03 Provide with a marine edge with a 2" turn down with a tight hem at the exposed sides.
- 04 Provide two (2) 18" x 18" x 10" deep 14 gauge type 304 stainless steel sinks fully welded into the top.
- 05 Provide a 5" high 18 gauge 304 stainless steel removable scrap basket. The bottom is to be perforated with 1/4" diameter holes. Provide two (2) type 304 stainless steel 1" diameter tubular handles running from the back to the front of the basket. Provide four (4) type 304 stainless steel 1" tall x 1" diameter tubular legs at the bottom of the basket. The bottom of the legs to be fully welded closed. Fully weld the basket, handles and the legs.

- 06 Provide 1 5/8" diameter type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel flanged feet. Anchor the feet to the floor with stainless steel anchors. Fully weld the leg sockets the underbracing. Anchor the feet to the floor with stainless steel fasteners.
- 07 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at rear. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 07 Provide type 304 stainless steel crossrails in the locations shown by the drawings. Fully weld the crossrails to the legs.
- 08 Provide one (1) 1'-0" wide x length indicated on the drawing fully welded 16 gauge stainless steel wall mounted overshef. Provide 12 gauge fully welded type 304 stainless steel wall brackets. Mount the wall shelf 1'-6" above the work surface of the work table with stainless steel screws.
- 09 Support the shelf with 12 gauge type 304 stainless steel angled brackets fully welded to the uprights. Attach the shelf to the brackets with stainless steel acorn nuts in two (2) places at each bracket.

Accessories

- 1 ea. T & S model B-0133 pre-rinse faucet.
- 1 ea. T & S model B-0230-K installation kit.
- 1 ea. T & S model B-0156 add-on faucet.
- 1 ea. T & S model B-0109-01 wall bracket. Mount the bracket to the top extension with stainless steel screws.
- 2 ea. Component Hardware model DBN-8000 twist waste valve. Shorten the handle to be flush with the front of the sink bowl. Provide 14 gauge type 304 stainless steel brackets to support the handles. Attach to the sink bottom with stainless steel anchors.
- 1 ea. Edlund model KR-699 knife rack. Provide a 14 gauge type 304 stainless steel bracket for the knife holder. Locate the knife holder per the drawings. Attach the rack to the bracket with Component Hardware model Q37-0250 stainless steel keyhole studs welded to the bracket at the top.
- 1 ea. Component Hardware model S90-0020 drawer assembly. Locate the drawer per the drawings.

ITEM NO. 08 - TRASH CAN (6 REQUIRED)

CFS Brands model 34103223 trash can in a gray color. NSF listed.

Accessories

- 6 ea. Model 3691003 lid for in a gray color. NSF listed.
- 6 ea. Model 34103323 dolly in a black color.

ITEM NO. 09 - HAND SINK (7 REQUIRED)

Eagle Group model HSA-10 with all the standard features.

Accessories

- 7 ea. Model 300886 drain assembly.
- 7 ea. Model LRS left and right hand splash on the sinks.
- 7 ea. Component Hardware Group, Inc. model KL45-4002-RE1 faucets.
- 7 ea. Component Hardware Group, Inc. model KN91-0100 quik-wash faucet control. Install on the faucets.
- 1 ea. Model 326272 eye wash attachment. Install on the sink near item 11.

ITEM NO. 10 - NUMBER NOT USED

ITEM NO. 11 - WORK TABLE (1 REQUIRED)

Custom fabricated work table to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 01 Provide with a 8" high x 1" thick backsplash at the rear and high equipment. Attach the back splash to the wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Provide with a 2" turn down with a tight hem at the exposed sides.
- 03 Provide 1 5/8" diameter type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel feet. Fully weld the leg sockets the underbracing.
- 04 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at walls and high equipment. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 05 Provide type 304 stainless steel crossrails per the drawings. Fully weld the crossrails to the legs.
- 06 Provide one (1) 1'-0" wide x length indicated on the drawing fully welded 16 gauge stainless steel wall mounted overshef. Provide 12 gauge fully welded type 304 stainless steel wall brackets. Mount the wall shelf 1'-6" above the work surface of the work table with stainless steel screws.

Accessories

- 1 ea. Edlund model G-2S can opener. Edlund model G-2S manual can opener. Mount to the table in the location shown on the drawings with stainless steel screws per the manufactures requirements. Remove the exposed screw threads below the table top. Widen the underbracing at the can opener to allow clearance for the mounting screws.
- 1 ea. Edlund model KR-699 knife rack. Provide a 14 gauge type 304 stainless steel bracket for the knife holder. Locate the knife holder per the drawings. Attach the rack to the bracket with Component Hardware model Q37-0250 stainless steel keyhole studs welded to the bracket at the top.
- 1 ea. Component Hardware model S90-0020 drawer assembly. Locate the drawer per the drawings.

ITEM NO. 12 - MOBILE TRAY DRYING RACK (2 REQUIRED)

Metro model PR48VX2-XDR with all the standard features.

ITEM NO. 13 - CLEAN DISHTABLE & POT SINK (1 REQUIRED)

Custom fabricated clean dishtable & pot sink to be constructed per drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under top with fully welded closed ends where they are exposed. Sound deadened between top and underbracing.

Features:

- 01 Provide with a 10" high x 2" thick backsplash at walls. Attach back splash to wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.

- 02 Provide with a 3" high rolled rim at exposed sides. Locate top of rolled rim 3'-1" above finish floor.
- 03 Provide three (3) 26 1/2" front-to-back x 24" x wide x 11" deep sink compartments constructed with 14 gauge type 304 stainless steel fully welded integrally into the top.
- 04 Provide type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel bullet feet. Fully weld the leg sockets the underbracing.
- 05 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at rear and high equipment. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 06 Provide type 304 stainless steel crossrails per the drawings. Fully weld the crossrails to the legs.
- 07 Provide 1'-1" wide x length indicated on the drawing x 1" diameter fully welded stainless steel three-bar wall shelf at the sinks. Mount the rail shelf 1'-9" above the work surface.
- 08 Support the shelf with 12 gauge type 304 stainless steel angled brackets fully welded to the uprights
- 09 Provide a 14 gauge type 304 stainless steel wall panel behind the shelf per the drawings. Attach the panel to the wall with industrial adhesive.

Accessories

- 2 ea. T & S model B-0290 faucets.
- 3 ea. Component Hardware model DBN-8000 twist waste valve. Shorten the handle to be flush with the front of the sink bowl. Provide 14 gauge type 304 stainless steel brackets to support the handles. Attach to the sink bottom with stainless steel anchors.
- 3 ea. Component Hardware model J19-4962 brackets.

ITEM NO. 14 - VENTLESS DISHWASHER & BOOSTER HEATER (1 REQUIRED)

CMA model CMA-180-VL TALL with all the standard features.

Accessories

- 1 ea. 208 volts, three phase.
- 1 ea. Single point electrical connection.
- 1 ea. Provide with a built-in booster heater.
- 1 ea. Drain water tempering kit.

ITEM NO. 15 - SOILED DISHTABLE (1 REQUIRED)

Custom fabricated soiled dishtable to be constructed per drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features:

- 01 Provide with a 10" high x 2" thick backsplash at walls. Attach back splash to wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Provide with a 3" high rolled rim at exposed sides. Locate top of rolled rim 3'-1" above finish floor.

- 03 Provide a 1'-9" x 1'-9" x 12" deep 14 gauge type 304 stainless steel scrap sink welded integrally into top and 12 gauge type 304 stainless steel fully welded rack guide.
- 04 Provide a 5" high 18 gauge 304 stainless steel removable scrap basket. Bottom is to be perforated with 1/4" diameter holes. Provide two (2) type 304 stainless steel 1" diameter tubular handles running from back to front of basket. Provide four (4) type 304 stainless steel 1" tall x 1" diameter tubular legs at bottom of basket. Bottom of legs to be fully welded closed. Fully weld basket, handles and legs.
- 05 Provide a 6" wide x 2" deep 14 gauge type 304 stainless steel scupper drain welded integrally into top. Provide a removable fully welded stainless steel basket with a perforated bottom. Full weld two (2) 1/4" stainless steel grab rods across the width in two places.
- 06 Provide type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel bullet feet. Fully weld leg sockets to underbracing.
- 07 Provide type 304 stainless steel crossrails per drawings. Fully weld crossrails to legs.
- 08 Provide trash can space under top per drawings.
- 09 Provide a 5'-6" long cantilevered 16 gauge type 304 stainless steel slanted rack shelf with a 5'-6" long x 1" diameter rail fully welded stainless steel cantilevered rack storage shelf. Provide adjustable socket mounts on uprights for shelves. Attach uprights to wall at upright top. Mount slant rack shelf 1'-4" above rolled rim and mount rack storage shelf 1'-9" above slanted rack shelf.

Accessories:

- 1 ea. Component Hardware model E38-1012 basket drain in scrap sink.
- 1 ea. Component Hardware model E18-1822 basket drain in scupper drain.

ITEM NO. 16 - HOSE REEL (1 REQUIRED)

T & S Brass model B-1433-01M-QDS hose reel with standard features. Mount to wall with stainless steel fasteners near ceiling per manufacturer's requirements. Center spray valve over scrap sink.

Accessories:

- 2 ea. Model B-CVH1-2 check valves. Provide to plumbing contractor for installation into water lines.
- 2 ea. Model B-0109-01 wall brackets. Mount to wall with stainless steel screws.

ITEM NO. 17 - MOBILE ROTATING CONVECTION OVEN (1 REQUIRED)

Baxter Manufacturing model OV310G with all the standard features.

Accessories

- 1 ea. Model HTSNAT natural gas burners.
- 1 ea. Model GHSSTD standard gas connection.
- 1 ea. 120 volts, single phase.
- 1 ea. End-load twelve (12) pan capacity.
- 1 ea. Model STAND-12PAN stainless steel stand base.
- 1 set Polyurethane casters with brakes.
- 1 ea. Provide with Dormont model 1675KIT2S48PS gas hoses. Provide to the plumbing contractor for installation.

ITEM NO. 18 - MOBILE RANGE (1 REQUIRED)

Imperial model IHR-4-24-M with all the standard features.

Accessories

- 1 ea. Natural gas
- 1 ea. 3/4" rear gas connection.
- 1 ea. 3/4" gas regulator.
- 1 ea. Model IHMS-24 equipment stand.
- 1 ea. Polyurethane tired casters with brakes.
- 1 ea. Dormont model 1675KIT2S48PS gas connector hose kit. Provide to the plumbing contractor for installation.

ITEM NO. 19 - IVARIO PRO 2-S (1 REQUIRED)

Rational model IVARIO PRO 2-S with all the standard features.

Accessories

- 1 ea. 208 volts, three phase.
- 1 lot Model CAP Chef assistance program.
- 1 lot Model 9999.2220 certified installation.
- 1 lot Model 9999.2002 pre-installation site consultation.
- 1 lot Model 9999.1009 extended travel zones.
- 1 ea. Model 8730.1565US installation kit.
- 1 ea. Model 1900.1154US water filter system. Mount the unit on the side of the unit with stainless steel screws.
- 1 lot Model 9999.2271 certified installation.
- 1 ea. Model 1900.1155US replacement cartridges.
- 1 ea. Model 60.75.836 stand.
- 1 kt. Model 60.31.433 caster kit.
- 1 ea. Model 87.00.732US equipment placement system. Attach to the floor per the Manufacture's requirements.
- 1 ea. Model 60.73.920 cleaning kit.
- 1 st. Model 87.00.742 accessory package.
- 1 ea. Model 60.73.586 scoop.
- 1 ea. Model 60.74.666 strainer.

ITEM NO. 20 - PREP TABLE (1 REQUIRED)

Custom fabricated prep table to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 01 Provide with a 10" high x 2" thick backsplash at the rear and high equipment. Attach the back splash to the wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Extend splash at pre-rinse faucet per drawings. Extend counter bracing up to top of extension. Fully weld bracing to counter bracing. Provide with a removable finished back where exposed.
- 03 Provide with a marine edge with a 2" turn down with a tight hem at the exposed sides.
- 04 Provide two (2) 18" x 18" x 10" deep 14 gauge type 304 stainless steel sinks fully welded into the top.
- 05 Provide a 5" high 18 gauge 304 stainless steel removable scrap basket. The bottom is to be perforated with 1/4" diameter holes. Provide two (2) type 304 stainless steel 1" diameter tubular handles running from the back to the front of the basket. Provide four (4) type 304 stainless steel 1" tall x 1" diameter tubular

- legs at the bottom of the basket. The bottom of the legs to be fully welded closed. Fully weld the basket, handles and the legs.
- 06 Provide 1 5/8" diameter type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel flanged feet. Anchor the feet to the floor with stainless steel anchors. Fully weld the leg sockets the underbracing. Anchor the feet to the floor with stainless steel fasteners.
- 07 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at rear. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 07 Provide type 304 stainless steel crossrails in the locations shown by the drawings. Fully weld the crossrails to the legs.
- 08 Provide one (1) 1'-0" wide x length indicated on the drawing fully welded 16 gauge stainless steel wall mounted overshef. Provide 12 gauge fully welded type 304 stainless steel wall brackets. Mount the wall shelf 1'-6" above the work surface of the work table with stainless steel screws.
- 09 Support the shelf with 12 gauge type 304 stainless steel angled brackets fully welded to the uprights. Attach the shelf to the brackets with stainless steel acorn nuts in two (2) places at each bracket.

Accessories

- 1 ea. T & S model B-0133 pre-rinse faucet.
- 1 ea. T & S model B-0230-K installation kit.
- 1 ea. T & S model B-0156 add-on faucet.
- 1 ea. T & S model B-0109-01 wall bracket. Mount the bracket to the top extension with stainless steel screws.
- 2 ea. Component Hardware model DBN-8000 twist waste valve. Shorten the handle to be flush with the front of the sink bowl. Provide 14 gauge type 304 stainless steel brackets to support the handles. Attach to the sink bottom with stainless steel anchors.
- 1 ea. Edlund model KR-699 knife rack. Provide a 14 gauge type 304 stainless steel bracket for the knife holder. Locate the knife holder per the drawings. Attach the rack to the bracket with Component Hardware model Q37-0250 stainless steel keyhole studs welded to the bracket at the top.
- 1 ea. Component Hardware model S90-0020 drawer assembly. Locate the drawer per the drawings.

ITEM NO. 21. - MOBILE COMBI-OVEN (1 REQUIRED)

Rational model ICP 6-FUL/6-FULLL NG with all the standard features.

Accessories

- 1 ea. 208 volts, single phase.
- 1 ea. Hinge the doors on the right.
- 1 kt. Model 60.74.725 combi-duo staking kit.
- 1 ea. Model 60.31.635 mobile combi-duo kit.
- 1 lot CAP program.
- 1 lot Model 9999.2271 certified installation.
- 1 ea. Model 8720.1569US installation kit.
- 2 ea. Model 60.76.317 external core temperature probe.
- 1 cs. Model 56.01.535 detergent tablets.
- 1 cs. Model 56.00.598 defoamer tablets.
- 1 cs. Model 56.00.562 care tablets.
- 1 ea. Model 1900.1150US water filter system. Mount the unit on the side of the unit with stainless steel screws.

- 2 ea. Model 1900.1155US replacement cartridges.
- 1 ea. Provide with Dormont model W50BP2Q48PS water hose. Provide to the plumbing contractor for installation.
- 3 ea. Provide with Dormont model W50BP2@48 water hose. Provide to the plumbing contractor for installation.
- 1 ea. Provide with Dormont model 1675KIT2S48 gas hoses. Provide to the plumbing contractor for installation.
- 1 ea. Provide with Dormont model 1675KIT2S48PS gas hoses. Provide to the plumbing contractor for installation.

ITEM NO. 22 - VENTILATOR - EXISTING

ITEM NO. 23 - FIRE SUPPRESSION SYSTEM - EXISTING

ITEM NO. 24 - MOBILE PROOF/HOT CABINET (2 REQUIRED)

CresCor model 121-PH-UA-11D with all the standard features.

Accessories

- 2 ea. 120 volts, single phase.
- 2 ea. Model 1405-135 perimeter bumper
- 2 sets Provide with 5" polyurethane casters with brakes on all the casters.

ITEM NO. 25 - COOK'S TABLE (1 REQUIRED)

Custom fabricated cook's table to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

Features

- 01 Provide with a 8" high x 2" thick backsplash at the rear and high equipment. Attach the back splash to the wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Provide a 16 gauge type 304 stainless steel finished back on the exposed backsplash. Attach the finished back to the backsplash in a concealed manner with stainless steel fasteners.
- 03 Provide with a 2" turn down with a tight hem at the exposed sides.
- 04 Provide one (1) 18" front-to-back x 18" wide x 10" deep sink compartment constructed with 14 gauge type 304 stainless steel fully welded integrally into the top.
- 05 Provide 1 5/8" diameter type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel feet. Fully weld the leg sockets the underbracing. Anchor the feet to the floor with stainless steel fasteners.
- 06 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at walls and high equipment. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 07 Provide type 304 stainless steel crossrails per the drawings. Fully weld the crossrails to the legs.
- 08 Provide one (1) 1'-0" wide x length indicated on the drawing fully welded 16 gauge stainless steel wall mounted overshef. Provide 12 gauge fully welded type 304 stainless steel wall brackets. Mount the wall shelf 1'-6" above the work surface of the work table with stainless steel screws.

Accessories

- 1 ea. T & S model B-0320 faucets.
- 1 ea. Component Hardware model DBN-8000 twist waste valve. Shorten the handle to be flush with the front of the sink bowl. Provide 14 gauge type 304 stainless steel brackets to support the handles. Attach to the sink bottom with stainless steel anchors.
- 1 ea. Advance Tabco model SW-132 wall mounted pot rack. Modify the length per the drawings. Mount the wall shelf with stainless steel screws.
- 1 ea. Edlund model G-2S can opener. Edlund model G-2S manual can opener. Mount to the table in the location shown on the drawings with stainless steel screws per the manufactures requirements. Remove the exposed screw threads below the table top. Widen the underbracing at the can opener to allow clearance for the mounting screws.
- 1 ea. Edlund model KR-699 knife rack. Provide a 14 gauge type 304 stainless steel bracket for the knife holder. Locate the knife holder per the drawings. Attach the rack to the bracket with Component Hardware model Q37-0250 stainless steel keyhole studs welded to the bracket at the top.
- 1 ea. Component Hardware model S90-0020 drawer assembly. Locate the drawer per the drawings.

ITEM NO. 26 - WORK TABLE (1 REQUIRED)

Custom fabricated work table to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 02 Provide with a 8" high x 1" thick backsplash at the rear and high equipment. Attach the back splash to the wall with stainless steel screws at a 4'-0" o.c. maximum spacing with 14 gauge stainless steel Z-clips.
- 02 Provide with a 2" turn down with a tight hem at the exposed sides.
- 03 Provide 1 5/8" diameter type 304 stainless steel legs with stainless steel leg sockets and adjustable stainless steel feet. Fully weld the leg sockets the underbracing.
- 04 Provide a 16 gauge type 304 stainless steel undershelves per the drawings. Turn the undershelves up 2" at walls and high equipment. Fully weld the undershelves to the legs. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 05 Provide type 304 stainless steel crossrails per the drawings. Fully weld the crossrails to the legs.
- 06 Provide one (1) 1'-0" wide x length indicated on the drawing fully welded 16 gauge stainless steel wall mounted overshef. Provide 12 gauge fully welded type 304 stainless steel wall brackets. Mount the wall shelf 1'-6" above the work surface of the work table with stainless steel screws.

Accessories

- 1 ea. Edlund model G-2S can opener. Edlund model G-2S manual can opener. Mount to the table in the location shown on the drawings with stainless steel screws per the manufactures requirements. Remove the exposed screw threads below the table top. Widen the underbracing at the can opener to allow clearance for the mounting screws.
- 1 ea. Edlund model KR-699 knife rack. Provide a 14 gauge type 304 stainless steel bracket for the knife holder. Locate the knife holder per the drawings. Attach

- the rack to the bracket with Component Hardware model Q37-0250 stainless steel keyhole studs welded to the bracket at the top.
- 1 ea. Component Hardware model S90-0020 drawer assembly. Locate the drawer per the drawings.

ITEM NO. 27 - BACK-UP COUNTER (3 REQUIRED)

Custom fabricated back-up counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 01 Provide with an 8" high x 1" thick backsplash at the walls and high equipment. Extend the top through the pass-through window.
- 02 Provide with a 2" turn down with a tight hem at the exposed sides.
- 03 Provide one (1) 15" front-to-back x 12" wide x 10" deep sink compartment constructed with 14 gauge type 304 stainless steel fully welded integrally into the top.
- 04 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 05 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the doors.
- 06 Provide a 12 gauge type 304 stainless steel fully welded 4" high curb at the counter body. Seal the curb to the wall and floor with silicone caulking. Notch the floor sink around the floor sink.

Accessories

- 3 ea. T & S model B-0320 faucet.
- 3 ea. Component Hardware model DBN-8000 twist waste valve. Shorten the handle to be flush with the front of the sink bowl. Provide 14 gauge type 304 stainless steel brackets to support the handles. Attach to the sink bottom with stainless steel anchors.

ITEM NO. 28 - MOBILE REFRIGERATOR (2 REQUIRED)

Continental Refrigerator model D1RESNSSHD with all the standard features.

Accessories

- 2 ea. Hinge the doors per the drawings.
- 2 ea. 120 volts, single phase with a cord and plug.
- 2 lots Model 50-P008A-E universal type pan slides.
- 2 ea. Space all slides equally throughout the cabinets.
- 2 sets 5" polyurethane casters with brakes on all casters.

ITEM NO. 29 - MOBILE HOT CABINET (2 REQUIRED)

Continental Refrigerator model DL1WE-SS-HD with all the standard features.

Accessories

- 2 ea. Hinge the doors per the drawings.
- 2 ea. 208 volts, single phase with a cord and plug.
- 2 lots Model 50-P008A-E universal type pan slides.

- 2 ea. Space all slides equally throughout the cabinets.
- 2 sets 5" polyurethane casters with brakes on all casters.

ITEM NO. 30 - DROP-IN COLD FOOD WELLS (4 REQUIRED)

Low Temp Industries model DI-TA-20-02 with all the standard features.

Accessories

- 4 ea. 120 volts, single phase.

ITEM NO. 31 - MOBILE ADVENTURE SERVING COUNTER (1 REQUIRED)

Custom fabricated mobile adventure serving counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing. Construct the counter in as many sections as required to access the building. Assemble and field weld the sections together at the final location. Coordinate the section sizes with Trigon.

Features

- 01 Provide with a 2" turn down with a tight hem at the sides.
- 02 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing. Notch the undershelf around the floor sink.
- 03 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the panels.
- 04 Provide a 16 gauge type 304 stainless steel double pan hinged doors with fully welded louvers per the elevations. Fully weld the corners on the panels.
- 05 Provide a Component Hardware Group, Inc. model P46-1012 pull at the doors. Attach with stainless steel screws.
- 06 Provide a Component Hardware Group, Inc. model M32-2401 magnetic catches at the doors. Install the catch per the manufactures requirements.
- 07 Provide steel j-boxes on the counter body per the drawings and elevations for switches and controls. Provide with stainless steel cover plates. Weld the j-boxes to the counter.
- 08 Provide removable 18 gauge stainless steel panels on the sides per the elevations. Provide a 6" x 6" one piece panel at the corners. Attach the panels to the counter with 14 gauge stainless steel Z-clips at the bottom of the panels.
- 09 Provide a quarter-turn ball valve drain valve in an 18 gauge fully welded stainless steel recess per the drawings. Pre-pipe the hot well drain to the valve and the drain line to the floor drain per current codes.
- 10 Provide polyurethane tired casters with brakes.

Accessories

- 1 ea. T & S model B-0208 faucet. Provide a hot water indicator on the handle.
- 1 Lot Versa-Gard. sneeze guard per quote number Q016180 and the drawings in a brushed stainless steel finish. Provide a countertop mount. Install into the counter top per the manufactures requirements.

ITEM NO. 32 - DROP-IN HOT FOOD WELLS (1 REQUIRED)

Low Temp Industries model DI-TW-DW-20-05 with all the standard features.

Accessories

1 ea. 208 volts, single phase.

ITEM NO. 33 - DROP-IN COLD FOOD WELLS (3 REQUIRED)

Low Temp Industries model DI-TA-20-03 with all the standard features.

Accessories

3 ea. 120 volts, single phase.

ITEM NO. 34 - GRAB-N-GO DISPLAY REFRIGERATOR (2 REQUIRED)

Structural Concepts model B3632 with all the standard features.

Accessories

- 2 ea. 120 volts, single phase.
- 2 ea. Provide with front access pull-out refrigeration, a front air intake and a rear discharge.
- 2 ea. Clean Sweep automatic condenser coil cleaner.
- 2 ea. Rear doors.
- 2 ea. Stainless steel interior.
- 2 ea. Provide with a stainless steel exterior.
- 2 ea. Provide with a stainless steel exterior end panel with a mirror interior and with a vinyl edge at the serving counters at the wall.
- 2 ea. Stainless steel end panel with a counter height cut-away insulated glass, mirror interior and with a vinyl edge at the counter sides.
- 2 ea. Provide with a black lower front panel.
- 2 set Provide with LED 4000K lights on the shelves.
- 2 ea. Provide with a locking roll-down security cover.
- 2 set Casters.

ITEM NO. 35 - MOBILE PIZZA SERVING COUNTER (1 REQUIRED)

Custom fabricated mobile pizza serving counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing. Construct the counter in as many sections as required to access the building. Assemble and field weld the sections together at the final location. Coordinate the section sizes with Trigon.

Features

- 01 Provide with a 2" turn down with a tight hem at the sides.
- 02 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing. Notch the undershelf around the floor sink.
- 03 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the panels.
- 04 Provide a 16 gauge type 304 stainless steel double pan hinged doors with fully welded louvers per the elevations. Fully weld the corners on the panels.
- 05 Provide a Component Hardware Group, Inc. model P46-1012 pull at the doors. Attach with stainless steel screws.
- 06 Provide a Component Hardware Group, Inc. model M32-2401 magnetic catches at the doors. Install the catch per the manufactures requirements.

- 07 Provide steel j-boxes on the counter body per the drawings and elevations for switches and controls. Provide with stainless steel cover plates. Weld the j-boxes to the counter.
- 08 Provide removable 18 gauge stainless steel panels on the counter sides per the elevations. Provide a 6" x 6" one piece panel at the corners. Attach the panels to the counter with 14 gauge stainless steel Z-clips at the bottom of the panels.
- 09 Provide a quarter-turn ball valve drain valve in an 18 gauge fully welded stainless steel recess per the drawings. Pre-pipe the hot well drain to the valve and the drain line to the floor drain per current codes.
- 10 Provide polyurethane tired casters with brakes.

Accessories

- 1 ea. T & S model B-0208 faucet. Provide a hot water indicator on the handle.
- 1 Lot Versa-Gard. sneeze guard per quote number Q016180 and the drawings in a brushed stainless steel finish. Provide a countertop mount. Install into the counter top per the manufactures requirements.

ITEM NO. 36 - DROP-IN HOT FOOD WELLS (1 REQUIRED)

Low Temp Industries model DI-TW-DW-20-03 with all the standard features.

Accessories

- 1 ea. 208 volts, single phase.

ITEM NO. 37 - DROP-IN PIZZA WARMERS (1 REQUIRED)

Hatco model GRSBF-60I with all the standard features.

Accessories

- 1 ea. 120 volts, single phase.
- 1 ea. Model GRSB-FLUSH-ITC flush mount electronic control box. Mount in the counter face per the drawings.
- 1 ea. Model STANDARD flush mounted bezel with a stainless steel finish.
- 1 ea. Model COND-6 6" conduit.

ITEM NO. 38 - BACK-UP COUNTER (1 REQUIRED)

Custom fabricated back-up counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing.

Features

- 01 Provide with an 8" high x 1" thick backsplash at the walls and high equipment. Extend the top through the pass-through window.
- 02 Provide with a 2" turn down with a tight hem at the exposed sides.
- 03 Provide a 3/4" deep fully welded recess in the top for the cutting board. Fully weld stainless steel tabs in the recess to stabilize the cutting board per the drawings.
- 04 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing.
- 05 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the doors.

- 06 Provide a 12 gauge type 304 stainless steel fully welded 4" high curb at the counter body. Seal the curb to the wall and floor with silicone caulking. Notch the floor sink around the floor sink.

Accessories

- 1 ea. 24" x 24" x 3/4" thick white poly cutting board. Radius all of the edges to remove the sharp edges.

ITEM NO. 39 - ROLL-IN HOT CABINET (1 REQUIRED)

Continental Refrigerator model DL1WI-SS with all the standard features.

Accessories

- 1 ea. Hinge the doors per the drawings.
1 ea. 208 volts, single phase with a cord and plug.

ITEM NO. 40 - ICE MAKER (1 REQUIRED)

Scotsman model C0322SA-1 with all the standard features.

Accessories

- 1 ea. 120 volts, single phase.
1 ea. Model B322S ice bin.
1 ea. Stainless steel legs.
1 ea. Everpure model EV932952 water filter assembly. Mount on the side of the ice maker and bin with stainless steel screws.
1 ea. Everpure model EV969301 7CLM replace cartridge.

ITEM NO. 41 - ROLL-IN RACK (2 REQUIRED)

New Age model 1637 with all the standard features. Only one (1) shown on the plan.

Accessories

- 2 sets Provide with polyurethane tired casters with brakes.
2 ea. Model PB perimeter bumpers.

ITEM NO. 42 - MOBILE GRILL SERVING COUNTER (1 REQUIRED)

Custom fabricated mobile grill serving counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing. Construct the counter in as many sections as required to access the building. Assemble and field weld the sections together at the final location. Coordinate the section sizes with Trigon.

Features

- 01 Provide with a 2" turn down with a tight hem at the sides.
02 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing. Notch the undershelf around the floor sink.
03 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the panels.
04 Provide a 16 gauge type 304 stainless steel double pan hinged doors with fully welded louvers per the elevations. Fully weld the corners on the panels.

- 05 Provide a Component Hardware Group, Inc. model P46-1012 pull at the doors. Attach with stainless steel screws.
- 06 Provide a Component Hardware Group, Inc. model M32-2401 magnetic catches at the doors. Install the catch per the manufactures requirements.
- 07 Provide steel j-boxes on the counter body per the drawings and elevations for switches and controls. Provide with stainless steel cover plates. Weld the j-boxes to the counter.
- 08 Provide removable 18 gauge stainless steel panels on the counter sides per the elevations. Provide a 6" x 6" one piece panel at the corners. Attach the panels to the counter with 14 gauge stainless steel Z-clips at the bottom of the panels.
- 09 Provide a quarter-turn ball valve drain valve in an 18 gauge fully welded stainless steel recess per the drawings. Pre-pipe the hot well drain to the valve and the drain line to the floor drain per current codes.
- 10 Provide polyurethane tired casters with brakes.

Accessories

- 1 ea. T & S model B-0208 faucet. Provide a hot water indicator on the handle.
- 1 Lot Versa-Gard. sneeze guard per quote number Q016180 and the drawings in a brushed stainless steel finish. Provide a countertop mount. Install into the counter top per the manufactures requirements.

ITEM NO. 43 - DROP-IN HOT FOOD WELLS (1 REQUIRED)

Low Temp Industries model DI-TW-DW-20-04 with all the standard features.

Accessories

- 1 ea. 208 volts, single phase.

ITEM NO. 44 - MOBILE MEXICAN SERVING COUNTER (1 REQUIRED)

Custom fabricated mobile mexican serving counter to be constructed per the drawings with a fully welded 14 gauge type 304 stainless steel top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top with fully welded closed ends where they are exposed. Sound deadened between the top and the underbracing. Construct the counter in as many sections as required to access the building. Assemble and field weld the sections together at the final location. Coordinate the section sizes with Trigon.

Features

- 01 Provide with a 2" turn down with a tight hem at the sides.
- 02 Provide a 16 gauge type 304 stainless steel fully welded counter body with a 16 gauge type 304 stainless steel fully welded undershelves per the drawing elevations. Provide 12 gauge type 304 stainless steel channel underbracing under the undershelves. Sound deadened between the undershelves and the underbracing. Notch the undershelf around the floor sink.
- 03 Provide a 16 gauge type 304 stainless steel double pan hinged doors per the elevations. Fully weld the corners on the panels.
- 04 Provide a 16 gauge type 304 stainless steel double pan hinged doors with fully welded louvers per the elevations. Fully weld the corners on the panels.
- 05 Provide a Component Hardware Group, Inc. model P46-1012 pull at the doors. Attach with stainless steel screws.
- 06 Provide a Component Hardware Group, Inc. model M32-2401 magnetic catches at the doors. Install the catch per the manufactures requirements.
- 07 Provide steel j-boxes on the counter body per the drawings and elevations for switches and controls. Provide with stainless steel cover plates. Weld the j-boxes to the counter.

- 08 Provide removable 18 gauge stainless steel panels on the counter sides per the elevations. Provide a 6" x 6" one piece panel at the corners. Attach the panels to the counter with 14 gauge stainless steel Z-clips at the bottom of the panels.
- 09 Provide a quarter-turn ball valve drain valve in an 18 gauge fully welded stainless steel recess per the drawings. Pre-pipe the hot well drain to the valve and the drain line to the floor drain per current codes.
- 10 Provide polyurethane tired casters with brakes.

Accessories

- 1 ea. T & S model B-0208 faucet. Provide a hot water indicator on the handle.
- 1 Lot Versa-Gard. sneeze guard per quote number Q016180 and the drawings in a brushed stainless steel finish. Provide a countertop mount. Install into the counter top per the manufactures requirements.

ITEM NO. 45 - MOBILE PASS-THRU REFRIGERATOR (2 REQUIRED)

Continental Refrigerator model D1RENSSPTHD with all the standard features.

Accessories

- 2 ea. Hinge the doors per the drawings.
- 2 ea. 120 volts, single phase with a cord and plug.
- 2 lots Model 50-P008A-E universal type pan slides.
- 2 ea. Space all slides equally throughout the cabinets.
- 2 sets 5" polyurethane casters with brakes on all casters.

ITEM NO. 46 - MOBILE PASS-THRU HOT CABINET (2 REQUIRED)

Continental Refrigerator model DL1WE-SS-PT-HD with all the standard features.

Accessories

- 2 ea. Hinge the doors per the drawings.
- 2 ea. 208 volts, single phase with a cord and plug.
- 2 lots Model 50-P008A-E universal type pan slides.
- 2 ea. Space all slides equally throughout the cabinets.
- 2 sets 5" polyurethane casters with brakes on all casters.

ITEM NO. 47 - NUMBER NOT USED

ITEM NO. 48 - NUMBER NOT USED

ITEM NO. 49 - NUMBER NOT USED

ITEM NO. 50 - NUMBER NOT USED

ITEM NO. 51 - NUMBER NOT USED

ITEM NO. 52 - CASHIER COUNTER (2 REQUIRED)

Custom fabricated cashier serving counter to be constructed with a Corian Artic Ice top. Provide 12 gauge fully welded type 304 stainless steel channel underbracing under the top.

Features

- 01 Provide with a 2" turn down with a tight hem at the exposed sides.
- 02 Provide a 16 gauge type 304 stainless steel fully welded counter body per the drawing elevations.

- 03 Provide a 16 gauge type 304 stainless steel fully welded foot rest per the drawing elevations. Provide 12 gauge type 304 stainless steel fully welded channel underbracing under the foot rest. Sound deadened between the undershelves and the underbracing.
- 04 Provide a 16 gauge type 304 stainless steel fully welded cash drawer per the elevations. Provide a 16 gauge type 304 stainless steel fully welded drawer face. Provide Component Hardware S52 series drawer slides. Weld the slides to the drawer assembly. Provide Component Hardware model P62-1010 pulls. Weld the pulls to the drawer face from the inside of the face.
- 05 Provide removable 18 gauge stainless steel panels on the counter fronts and side per the elevations. Provide a 6" x 6" one piece panel at the corners. Attach the panels to the counter with 14 gauge stainless steel Z-clips at the bottom of the panels.
- 06 Provide polyurethane tired casters with brakes.

ITEM NO. 53 - POS SYSTEM BY THE OWNER

ITEM NO. 54 - CHIP RACK BY THE VENDOR

END OF SECTION

**SECTION 123600
COUNTERTOPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

- A. Section 064000 - Architectural Woodwork.

1.03 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program.
- B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.
- C. NEMA LD 3 - High-Pressure Decorative Laminates.
- D. PS 1 - Structural Plywood.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizing and configuration of countertops with associated casework and adjacent construction.
 - 2. Coordinate sizing and locations of cutouts for plumbing fixtures with base cabinet configurations for proper alignments as indicated on Drawings.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other Sections.
 - 1. Indicate plans, sections, dimensions, seam locations, component sizes, edge details, fabrication details, attachment provisions, sizes of furring, blocking, and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in countertops.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with not less than three years of documented experience.
- C. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Field Measurements: Verify dimensions of construction to receive countertops by field measurements before fabrication and indicate measurements on Shop Drawings.

1.09 WARRANTY

- A. Solid Surface Material Manufacturer Warranty: Provide manufacturer's standard warranty for solid surface material for period of 10 years against material defects.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - b. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Skirts: As indicated on Drawings.
 - 7. Fabricate in accordance with manufacturer's standard requirements.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to walls with contact surfaces set in waterproof adhesive.
 - 2. Height: 4 inches, unless otherwise indicated.

- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
 - 1. Arrange seams symmetrically or in orderly locations, minimum 12 inches from edges of sink and similar cutouts.
- D. Cutouts and Holes:
 - 1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - 2. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - 3. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 4. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
- E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.
- D. Verify actual site dimensions and location of adjacent materials prior to commencing work.
- E. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0"

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach countertops using compatible adhesive.
- C. Set countertops to comply with requirements indicated. Shim and adjust, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances. Install anchors and other attachments indicated or necessary to secure countertops in place.
- D. Bond joints with countertop manufacturer's recommended adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 21 0500
FIRE SUPPRESSION PIPING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish and install complete, tested and ready for use wet pipe or dry pipe automatic sprinkler system as described in these Specifications. Provide new fire service and risers inside building complete with all necessary flow switches, alarms, etc. to comply with NFPA 13 and all applicable local codes. The design of the system shall be performed by a NICET LEVEL 3 or 4 certified designer.
- B. The Fire Protection Contractor shall ensure that all work conforms to local codes and regulations. The Fire Protection Contractor shall: 1) Verify existing water pressure at site prior to bidding. 2) Design pipe sizes based on existing water pressure or provide and install new fire pump as required to adequately provide proper coverage for building, and 3) Coordinate all electrical wiring and connections to pumps, valves, tamper switches, flow switches, etc. Wiring to be done under Division 26. Installation of the system shall be by a Fire Protection Contractor which is certified by the State in which the system will be installed.

1.02 SYSTEM DESCRIPTIONS

- A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.
- B. Automatic Wet-Type, Class II Standpipe System: Includes NPS 1-1/2 hose stations. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
- C. Wet-Pipe Return Bend Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.03 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum Residual Pressure at Each Hose-Connection Outlet: 65 psig.
 - 2. Unless Otherwise Indicated, the Following Is Maximum Residual Pressure at Required Flow at Each Hose-Connection Outlet: 100 psig.
- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Churches: Light Hazard.
 - c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. General Storage Areas: Ordinary Hazard, Group 1.
 - e. Laundries: Ordinary Hazard, Group 1.
 - f. Libraries, Except Stack Areas: Light Hazard.
 - g. Library Stack Areas: Ordinary Hazard, Group 2.
 - h. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - i. Office and Public Areas: Light Hazard.
 - j. Residential Living Areas: Light Hazard.
 - k. Restaurant Service Areas: Ordinary Hazard, Group 1.
 - l. Insert area: Insert hazard and group.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm/sq.ft. over 1500 sq. ft.

- b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq.ft. over 1500 sq. ft.
- c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft.
- 4. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 120 sq. ft.
 - b. Storage Areas: 130 sq. ft..
 - c. Mechanical Equipment Rooms: 130 sq. ft.
 - d. Electrical Equipment Rooms: 130 sq. ft.
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.04 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
- C. Field test reports and certificates.
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
 - 3. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
 - 4. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - 5. NFPA 230, "Fire Protection of Storage."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

2.02 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.
 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.
 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Victaulic Co. of America.
 - b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
 - c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
 - d. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.03 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
 1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 5. Steel Threaded Couplings: ASTM A 865.
- B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.
 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Ductilic, Inc.
 - 4) JDH Pacific, Inc.
 - 5) National Fittings, Inc.
 - 6) Shurjoint Piping Products, Inc.
 - 7) Southwestern Pipe, Inc.
 - 8) Star Pipe Products; Star Fittings Div.
 - 9) Victaulic Co. of America.
 - 10) Ward Manufacturing.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

- C. Saddle taps are not allowed without written permission from AHJ.

2.04 FLEXIBLE CONNECTORS

- A. Flexible connectors are not allowed without written permission of the AHJ. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
1. NPS 2 and Smaller: Threaded.
 2. NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
- B. Manufacturers:
1. Anamet Inc.
 2. Flex-Hose Co., Inc.
 3. Flexicraft Industries.
 4. Flex-Pression, Ltd.
 5. Flex-Weld, Inc.
 6. Hyspan Precision Products, Inc.
 7. Mercer Rubber Co.
 8. Metraflex, Inc.
 9. Proco Products, Inc.
 10. Unaflex Inc.
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.05 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Outlet Specialty Fittings:
1. Manufacturers:
 - a. Anvil International, Inc.
 - b. Central Sprinkler Corp.
 - c. Ductilic, Inc.
 - d. JDH Pacific, Inc.
 - e. National Fittings, Inc.
 - f. Shurjoint Piping Products, Inc.
 - g. Southwestern Pipe, Inc.
 - h. Star Pipe Products; Star Fittings Div.
 - i. Victaulic Co. of America.
 - j. Ward Manufacturing.
 2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
 3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
1. Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Fire-End and Croker Corp.
 - c. Viking Corp.
 - d. Victaulic Co. of America.

- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Potter-Roemer; Fire-Protection Div.
- E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Manufacturers:
 - a. AGF Manufacturing Co.
 - b. Central Sprinkler Corp.
 - c. G/J Innovations, Inc.
 - d. Triple R Specialty of Ajax, Inc.
- F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
 - 1. Manufacturers:
 - a. CECA, LLC.
 - b. Merit.

2.06 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Gate Valves with Wall Indicator Posts:
 - 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench hand wheel, extension rod, locking device, and cast-iron barrel.
 - 3. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. McWane, Inc.; Kennedy Valve Div.
 - c. NIBCO.
 - d. Stockham.
- C. Butterfly Valves: UL 1091.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.
 - 2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Global Safety Products, Inc.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Mueller Company.
 - 5) NIBCO.
 - 6) Pratt, Henry Company.
 - 7) Victaulic Co. of America.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Co.; Waterous Co.
 - c. Central Sprinkler Corp.

- d. Clow Valve Co.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Firematic Sprinkler Devices, Inc.
 - h. Globe Fire Sprinkler Corporation.
 - i. Grinnell Fire Protection.
 - j. Hammond Valve.
 - k. Matco-Norca, Inc.
 - l. McWane, Inc.; Kennedy Valve Div.
 - m. Mueller Company.
 - n. NIBCO.
 - o. Potter-Roemer; Fire Protection Div.
 - p. Reliable Automatic Sprinkler Co., Inc.
 - q. Star Sprinkler Inc.
 - r. Stockham.
 - s. United Brass Works, Inc.
 - t. Venus Fire Protection, Ltd.
 - u. Victaulic Co. of America.
 - v. Watts Industries, Inc.; Water Products Div.
- E. Gate Valves: UL 262, OS&Y type.
- 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 4) United Brass Works, Inc.
 - 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) Clow Valve Co.
 - 2) Crane Co.; Crane Valve Group; Crane Valves.
 - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 4) Hammond Valve.
 - 5) Milwaukee Valve Company.
 - 6) Mueller Company.
 - 7) NIBCO.
 - 8) Red-White Valve Corp.
 - 9) United Brass Works, Inc.
- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
- 1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch Visual.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. of America.
 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Grinnell Fire Protection.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Milwaukee Valve Company.

- 5) NIBCO.
- 6) Victaulic Co. of America.

2.07 UNLISTED GENERAL-DUTY VALVES

- A. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- B. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- C. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.08 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. Central Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Sprinkler Corporation.
 - e. Grinnell Fire Protection.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Star Sprinkler Inc.
 - h. Venus Fire Protection, Ltd.
 - i. Victaulic Co. of America.
 - j. Viking Corp.
 - 2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
 - b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- B. Automatic Drain Valves: UL 1726, NPS 3/4 ball-check device with threaded ends.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. Grinnell Fire Protection.

2.09 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.
- B. Manufacturers:
 - 1. AFAC Inc.
 - 2. Central Sprinkler Corp.
 - 3. Firematic Sprinkler Devices, Inc.
 - 4. Globe Fire Sprinkler Corporation.
 - 5. Grinnell Fire Protection.
 - 6. Reliable Automatic Sprinkler Co., Inc.
 - 7. Star Sprinkler Inc.
 - 8. Venus Fire Protection, Ltd.
 - 9. Victaulic Co. of America.
 - 10. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 199, for nonresidential applications.
 - 2. UL 1626, for residential applications.

3. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
 1. Concealed ceiling sprinklers, including cover plate.
 2. Flush ceiling sprinklers, including escutcheon.
 3. Pendent sprinklers.
 4. Quick-response sprinklers.
 5. Recessed sprinklers, including escutcheon.
 6. Sidewall sprinklers.
 7. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 HOSE CONNECTIONS

- A. Manufacturers:
 1. AFAC Inc.
 2. Central Sprinkler Corp.
 3. Elkhart Brass Mfg. Co., Inc.
 4. Fire-End and Croker Corp.
 5. Fire Protection Products, Inc.
 6. GMR International Equipment Corporation.
 7. Grinnell Fire Protection.
 8. Guardian Fire Equipment Incorporated.
 9. McWane, Inc.; Kennedy Valve Div.
 10. Mueller Company.
 11. Potter-Roemer; Fire-Protection Div.
 12. United Brass Works, Inc.
- B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
 2. Finish: Rough metal or chrome-plated.

2.11 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
 1. AFAC Inc.
 2. Central Sprinkler Corp.
 3. Elkhart Brass Mfg. Co., Inc.
 4. Fire-End and Croker Corp.
 5. Fire Protection Products, Inc.
 6. GMR International Equipment Corporation.
 7. Guardian Fire Equipment Incorporated.
 8. Potter-Roemer; Fire-Protection Div.

9. Reliable Automatic Sprinkler Co., Inc.
10. United Brass Works, Inc.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
 1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
 2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
 3. Finish: Polished chrome-plated.

2.12 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.
 1. Manufacturers:
 - a. AFAC Inc.
 - b. Central Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Sprinkler Corporation.
 - e. Grinnell Fire Protection.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Star Sprinkler Inc.
 - h. Viking Corp.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller
 - d. Potter Electric Signal Company.
 - e. System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.
- D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.

2.13 PRESSURE GAGES

- A. Manufacturers:
 1. AGF Manufacturing Co.
 2. AMETEK, Inc.; U.S. Gauge.
 3. Brecco Corporation.

4. Dresser Equipment Group; Instrument Div.
 5. Marsh Bellofram.
 6. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch diameter, dial pressure gage with range of 0 to 300 psig.
1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 2. Air System Piping: Include caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- C. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints.

3.02 STANDPIPE SYSTEM PIPING APPLICATIONS

- A. Grooved-end, black or galvanized, standard-weight steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.03 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. NPS 1-1/2 and Smaller: Plain-end, black, standard-weight steel pipe; locking-lug fittings; and twist-locked joints.
- B. NPS 2 and Larger: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.04 VALVE APPLICATIONS

- A. Drawings shall indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 - b. Throttling Duty: Use globe valves.

3.05 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Twist-Locked Joints: Insert plain-end piping into locking-lug fitting and rotate retainer lug one-quarter turn.
- D. Pressure-Sealed Joints: Use UL-listed tool and procedure. Include use of specific equipment, pressure-sealing tool, and accessories.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

3.06 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.

3.07 WATER-SUPPLY CONNECTION

- A. Connect fire-suppression piping to building's interior water distribution piping. Refer to Division 22 Section "Domestic Water Piping" for interior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water distribution piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.

3.08 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install drain valves on standpipes.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 1. Install standpipe system piping according to NFPA 14.
 2. Install sprinkler system piping according to NFPA 13.
- M. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft

metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

- O. Fill wet-standpipe system piping with water.
- P. Fill wet-pipe sprinkler system piping with water.

3.09 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- D. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.10 SPRINKLER APPLICATIONS

- A. Where specific sprinkler types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Pendant sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 - e. Residential Sprinklers: Dull chrome.

3.11 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.
- B. Install freestanding hose connections for access and minimum passage restriction.
- C. Install hose-connection valves with flow-restricting device, unless otherwise indicated.
- D. Install wall-mounting-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Refer to Division 10 Section "Fire-Protection Specialties" for cabinets.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install freestanding-type, fire department connections in level surface.
 - 1. Install protective pipe bollards on three sides of each fire department connection. Refer to Division 5 Section "Metal Fabrications" for pipe bollards.
- C. Install ball drip valve at each check valve for fire department connection.

3.14 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- F. Electrical Connections: Power wiring is specified in Division 26.
- G. Connect alarm devices to fire alarm.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding."
- I. Connect wiring according to Division 26 Section "Conductors and Cables."

3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 23 Section "Mechanical Identification."

3.16 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 4. Coordinate with fire alarm tests. Operate as required.
 - 5. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION

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SECTION 21 1100
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe.
- B. Valves.
- C. Fire department connections.

1.02 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.
- C. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- E. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2014.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2020.
- G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- H. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.
- I. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- J. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).
- K. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe; 2015.
- L. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2017.
- M. FM (AG) - FM Approval Guide; current edition.
- N. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturer's catalog information.
 - 3. Indicate valve data and ratings.
- D. Field Quality Control Submittals: Testing activities.
- E. Project Record Documents:

1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
- F. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. Valve Repacking Kits: One for each type and size of valve.

1.05 QUALITY ASSURANCE

- A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.
- D. Welder Qualifications:
 1. Certify in accordance with ASME BPVC-IX.
 2. Provide certificate of compliance from local Authority Having Jurisdiction, indicating approval of welders.
- E. Valves: Bearing product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- F. Products:
 1. Listed, classified, and labeled as suitable for the purpose specified and indicated.
 2. Refer to FM (AG) - FM Approval Guide and UL (DIR).
- G. Perform Work in accordance with local authorities having jurisdiction, municipality, and water utility requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

1.08 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

2.02 WATER PIPE

- A. Steel Pipe: Standard weight, zinc-coated, listed, ASTM A53/A53M.
 - 1. Fittings: Comply with Cast-Iron Threaded Flanges: ASME B16.1 or ASME B16.4 Class 125, zinc-coated.
 - 2. Mechanically Factory Applied Protective Materials:
 - a. Clean by wire brushing and solvent cleaning.
 - b. Apply one coat of coal-tar primer and two coats of coal-tar enamel complying with AWWA C203.
 - c. Protect threaded pipe ends and fittings prior to coating.
 - d. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
 - e. Steel Threaded Couplings: ASTM A 865.
 - 3. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.
 - a. Grooved-Joint Piping Systems:
 - 1) Manufacturers:
 - (a) Anvil International, Inc.
 - (b) Central Sprinkler Corp.
 - (c) Ductilic, Inc.
 - (d) JDH Pacific, Inc.
 - (e) National Fittings, Inc.
 - (f) Shurjoint Piping Products, Inc.
 - (g) Southwestern Pipe, Inc.
 - (h) Star Pipe Products; Star Fittings Div.
 - (i) Victaulic Co. of America.
 - (j) Ward Manufacturing.
 - 2) Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - 3) Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.
- B. Ductile Iron Pipe: Listed, AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR rubber gasket with 3/4 inch diameter rods.
 - 3. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.
 - a. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern AWWA C153, ductile-iron compact pattern.
 - b. Gaskets: AWWA C111, rubber.
 - 4. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Victaulic Co. of America.
 - b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD.
 - c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.
 - d. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

- C. **Saddle taps are not allowed without written permission from AHJ.**

2.03 VALVES

- A. General:
1. Manufacturer's name and pressure rating marked on valve body.
 2. Minimum Compliance: UL (DIR) listed and labeled.
 3. Maximum Inlet Pressure: 400 psi.
 4. Maximum Service Temperature: 180 degrees F.
 5. Valve Coatings:
 - a. Internally: 4 mils, 0.004 inch epoxy, minimum.
 - b. Externally: Epoxy base then fire red enamel paint or heat-fused red epoxy paint.

2.04 FIRE DEPARTMENT CONNECTIONS:

- A. Manufacturers:
1. AFAC Inc.
 2. Central Sprinkler Corp.
 3. Elkhart Brass Mfg. Co., Inc.
 4. Fire-End and Croker Corp.
 5. Fire Protection Products, Inc.
 6. GMR International Equipment Corporation.
 7. Guardian Fire Equipment Incorporated.
 8. Potter-Roemer; Fire-Protection Div.
 9. Reliable Automatic Sprinkler Co., Inc.
 10. United Brass Works, Inc.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
1. Type: Flush, with two inlets and square or rectangular escutcheon plate.
 2. Type: Exposed, projecting, with two inlets and round escutcheon plate.
 3. Finish: Polished chrome-plated.
- C. Free-Standing Inlet:
1. Construction:
 - a. Type: Free standing type, ASTM B584 poured brass alloy.
 - b. Inlets: Two-way, 2-1/2 inch NPS female inlets, thread size compatible with fire department hardware.
 - c. Rated Working Pressure: 175 psi.
 - d. Double clapper-valves, rocker-lug caps and chain, and cast-in function-identifying lettering.
 - e. Finish: Polished brass.
 - f. Label: Sprinkler - Fire Department Connection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.

- C. Prepare pipe connections to equipment with flanges or unions.

3.03 INSTALLATION

A. General Requirements:

1. Location of Water Lines:
2. Sleeving:
 - a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
 - b. Provide ductile iron or Schedule 40 steel sleeves.
 - c. Fill annular space between pipe and sleeves with mastic.
 - d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.
3. Pipe Laying and Jointing:
 - a. Remove fins and burrs from pipe and fittings.
 - b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
 - c. Provide proper facilities for lowering pipe sections into trenches.
 - d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
 - e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
 - f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 - g. Wedging or blocking between bells and spigots will not be permitted.
 - h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
 - i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
 - j. Support piping at proper elevation and grade.
 - k. Secure firm, uniform support.
 - l. Wood support blocking will not be permitted.
 - m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 - n. Provide anchors and supports where indicated and necessary for fastening work into place.
 - o. Provide proper provisions for expansion and contraction of pipelines.
 - p. Keep trenches free of water until joints have been properly made.
 - q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
 - r. Do not install pipe during unacceptable trench conditions or inclement weather.
 - s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.
4. Connections to Existing Water Lines:
 - a. Ensure minimal interruption of service on the existing line.
 - b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
5. Penetrations:
 - a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
 - b. Fill annular space between sleeves and walls with rich cement mortar.
 - c. Fill annular space between pipe and sleeves with mastic.

B. Special Requirements:

1. Ductile Iron Piping:
 - a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
 - b. Allowable Deflection:

- 1) Maximum Allowable Deflection: As stated in AWWA C600.
 - 2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.
 - c. Pipe Anchorage:
 - 1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.
 - 2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.
 - 3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
 - 4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.
 - d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.
- C. Valves:
1. Set valves on solid bearing.
 2. Center and plumb valve box over valve.
 3. Set box cover flush with finished grade.

3.04 SERVICE CONNECTIONS

- A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.
- B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Caulk enlarged sleeve watertight.
- C. Anchor fire service main to interior surface of foundation wall.
- D. Provide 18 gauge, 0.0478 inch galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.05 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 4. Coordinate with fire alarm tests. Operate as required.
 5. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.06 CLEANING

- A. Upon completion of the installation of water lines and appurtenances, remove and haul away all surplus material, including debris resulting from the work.

3.07 CLOSEOUT ACTIVITIES

- A. See Section {3326} - {3326} for additional requirements.
- B. Demonstrate proper operation of equipment to Owner's designated representative.

- C. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.
- D. Training: Train Owner's personnel on operation and maintenance of system.

END OF SECTION

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**SECTION 21 1200
FIRE-SUPPRESSION STANDPIPES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire hose cabinets.
- B. Valves.
- C. Fire department connections.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2019.
- C. NFPA 1963 - Standard for Fire Hose Connections; 2019.
- D. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.
- C. Shop Drawings: Indicate supports, components, accessories, and sizes.
 - 1. Submit shop drawings and product data to Owner's insurance underwriter for approval.
 - 2. Submit proof of approval to Architect or Engineer/Engineer.
- D. Project Record Documents: Record actual locations of components.
- E. Operation Data: Include appropriate manufacturer's data.
- F. Maintenance Data: Include servicing requirements and test schedule.
- G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 14. Maintain one copy on site.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in shipping packaging until installation.

1.07 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE HOSE CABINETS

- A. Cabinet:
 - 1. Style: Recessed mounted.
 - 2. Tub: 16 gauge, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
 - 3. Door: 12 gauge, 0.1046 inch thick steel, flush, glazed with 1/4 inch (6.35 mm) thick wired glass full panel; hinged, positive latch device.
 - 4. Finish: Prime coated.

- B. Hose Rack: Steel with polished chrome finish; swivel type with pins and water stop.
- C. Hose: 1-1/2 inch diameter, 100 feet long, of polyurethane lined synthetic hose; mildew and rot-resistant.
- D. Nozzle: Chrome plated plastic; combination fog, straight stream, and adjustable shut-off.

2.02 VALVES

- A. Hose Connection Valve Cabinets:
 - 1. Style: Recessed, Semi-recessed, or surface mounted.
 - 2. Tub: 16 gauge, 0.0598 inch thick steel, prepared for pipe and accessory rough-in.
 - 3. Door: 12 gage, 0.1046 inch thick steel, hinged, positive latch device.
 - 4. Finish: Enameled, color red.

2.03 FIRE DEPARTMENT CONNECTIONS

- A. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
 - 1. Inlets: Two-way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
 - 2. Configuration: Horizontal.
 - 3. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 14.
- C. Locate and secure cabinets plumb and level.
- D. Locate hose station valve in cabinet at 60 inches above finished floor.
- E. Connect standpipe system to water source ahead of domestic water connection.
- F. Where static pressure exceeds 100 psi but is less than 100 psi at any hose station, provide pressure orifice disc in discharge of hose station valve to prevent pressure on hose exceeding 90 psi.
- G. Where static pressure exceeds 100 psi at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi.
- H. Flush entire system of foreign matter.

3.02 FIELD QUALITY CONTROL

- A. Division 1 - Field inspection, testing, and adjusting.
- B. Test entire system in accordance with NFPA 14.
- C. Test shall be witnessed by Fire Marshal.

END OF SECTION

**SECTION 21 1300
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 1963 - Standard for Fire Hose Connections; 2019.
- D. UL (DIR) - Online Certifications Directory; Current Edition.
- E. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect or Engineer/Engineer.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Designer's qualification statement.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 2. Sprinkler Wrenches: For each sprinkler type.
- J. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

- A. Comply with FM (AG) requirements.

- B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience and approved by manufacturer.
- E. Equipment and Components: Provide products that bear FM (AG) label or marking.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Tyco Fire Protection Products; _____: www.tyco-fire.com/#sle.
 - 2. Viking Corporation; _____: www.vikinggroupinc.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building control system.
- E. Provide fire department connections where indicated.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Semi-recessed or Recessed, pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome plated.
 - 4. Escutcheon Plate Finish: Chrome plated.
 - 5. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.
- B. Exposed Area Type: Upright type with guard.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Fusible solder link type or glass bulb type, temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed or Recessed, horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Chrome plated.

4. Escutcheon Plate Finish: Chrome plated.
 5. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler finish.

2.04 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
1. Activate electric alarm.
 2. Test and drain valve.
 3. Replaceable internal components without removing valve from installed position.
- B. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- C. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- E. Fire Department Connections:
1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
 - a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
 - b. Configuration: Horizontal.
 - c. Rated Working Pressure: 175 psi.
 - d. Sleeve: Brass, 18 inches height.
 - e. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
- F. Supervisory Switches: As required.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Install buried shut-off valves in valve box. Provide post indicator.
- D. Provide approved double check valve assembly at sprinkler system water source connection.
- E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- F. Locate outside alarm gong on building wall as indicated.
- G. Place pipe runs to minimize obstruction to other work.
- H. Place piping in concealed spaces above finished ceilings.
- I. Center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements.
- J. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- K. Flush entire piping system of foreign matter.
- L. Install guards on sprinklers where indicated.
- M. Hydrostatically test entire system.
- N. Require test be witnessed by Authority Having Jurisdiction.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 0500
BASIC PLUMBING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to other Mechanical Sections, in addition to Division 01 - General Requirements.
- B. If conflicts occur between Basic Mechanical Requirements and Division 01, the provisions of Division 01 shall normally dictate; however, the more stringent of the two shall be followed and the Contractor shall indicate the differences in written form and submit to the Engineer for clarification.

1.02 REGULATORY REQUIREMENTS

- A. Obtain and pay for permits and inspection fees for work included in this phase of the Contract. Comply in every respect with requirements of local inspection departments, National Fire Protection Association, and Local and State Ordinances and Codes. However, this requirement does not relieve the Contractor of the responsibility of complying with these specifications and drawings where specific conditions are of a higher quality and quantity than the requirements for complying with the most stringent of the codes, rules, ordinances or the specifications. Reference to standards is intended to be the latest revision of the standard.
- B. The applicable portions of the following listed codes and standards are hereby made a part of this specification, except where requirements are exceeded in these specifications and drawings.
 - 1. National Fire Protection Association (NFPA).
 - 2. Codes and Ordinances of the Local Authority Having Jurisdiction (AHJ).
 - 3. International Mechanical Code, with City Amendments, if applicable.
 - 4. International Plumbing Code, with City Amendments, if applicable.
 - 5. International Fuel Gas Code, with City Amendments, if applicable.
 - 6. International Building Code, with City Amendments, if applicable.

1.03 APPLICABLE STANDARDS

- A. The following organizations are hereinafter referenced as those whose standards are the basis for the designs, and manufactured items purchased shall conform to these standards where applicable.
 - 1. ANSI - American National Standards Institute.
 - 2. AGA - American Gas Association.
 - 3. ASME - American Society of Mechanical Engineers.
 - 4. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
 - 5. ASTM - American Society for Testing Materials.
 - 6. ARI - Air Conditioning and Refrigeration Institute.
 - 7. ADA - Americans with Disabilities Act.
 - 8. AMCA - Air Moving and Conditioning Association.
 - 9. NEBB - National Environmental Balancing Bureau
 - 10. AABC - Associated Air Balance Council
 - 11. UL - Underwriters' Laboratories, inc.
 - 12. AWWA - American Water Works Association.
- B. The following construction standards are required for the installations of this project:
 - 1. SMACNA - Sheet Metal and Air Contractors National Association.
 - 2. Fire Damper and Heat Stop Guide for Air Handling Systems.
 - 3. HVAC Duct Construction Standards.
 - 4. HVAC Air Duct Leakage Test Manual.
 - 5. High Pressure Duct Construction Standards.

6. Ducted Electric Heat Guide for Air Handling Systems.
7. Flexible Duct Performance & Installation Standards.
8. OSHA - Department of Labor: Occupational Safety and Health Standards, Latest Revisions.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications shall be considered complementary to each other and work referenced in one and not included in the other shall be furnished complete as though included in both. In case of conflicts between the drawings and specifications, the specifications shall take precedence.
- B. If floor plans, detail drawings, schedules, or specifications are not sufficiently detailed or explained, or if there are any discrepancies between architectural floor plans, specifications, schedules, or detail drawings, the Contractor shall notify the Engineer of same in writing, prior to bid opening. The Engineer will then inform the Contractor, in writing, which document takes precedence and/or furnish such information, drawings, etc., as required; after which the Contractor shall comply with same as part of this contract.
- C. If the Contractor deems it necessary to make departures from the drawings, details of such departures and reasons for same shall be submitted for acceptance. No departures shall be made without prior written acceptance by the Engineer.
- D. The Contractor shall be responsible for properly using the information on the Architectural, Structural, Civil, Mechanical and Electrical Drawings. All dimensional information shall be obtained from the appropriate drawings for new construction, and by taking actual measurements at the site for work to existing facilities. In no case shall drawings be scaled for dimensions. Should there be a discrepancy in figures, drawings, and/or specifications, the Engineer shall be notified immediately and shall determine the necessary adjustments.
- E. Contractors shall visit the site, verify all existing items indicated on plans and/or in specifications and familiarize themselves with existing conditions and local requirements. The Contractor shall accept conditions as they exist and each proposal shall reflect all costs occasioned by these conditions. The lack of specific information on drawings shall not relieve the Contractor of this responsibility, nor be reason for any extra charges. The submission of bids shall be considered an acknowledgment on the part of the bidder of his site visitation.
- F. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by CEC Corporation shall belong to CEC Corporation. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been met, including the payment of fees. Each page of the drawings, if prepared in whole or in part by CEC Corporation, and all pages of Mechanical, Plumbing and Fire Protection Sections of the Specifications are covered by copyright and may not be reproduced, published or used in any way without the permission of CEC Corporation.
- G. References made herein to materials, equipment, piping, or methods and procedures such as sterilization or cleaning, shall refer to the new items which are a part of this Contract, and shall not pertain to existing systems or material, etc., which are not being changed or rerouted under this Contract.

1.05 ADEQUACY OF WORK

- A. Drawings are diagrammatic and cannot show every connection in detail or every line of piping in its exact location. Details are subject to the requirements of ordinances and also structural and architectural conditions. Carefully investigate structural and finish conditions affecting the work, and arrange the work accordingly; furnish all such fittings and accessories as may be required to meet the conditions to give satisfactory operation.
- B. By submitting a bid on this work, the Contractor sets forth that his personnel has the necessary technical training and ability and that they will install this work in a satisfactory and workmanlike manner, up to the best standard of the trade, complete and in good working order.

- C. Should any discrepancy or apparent difference occur between Drawings and Specifications, or should an error occur in the work of others affecting the mechanical-electrical work, the Contractor shall notify the Engineer at once. If the Contractor proceeds with the work affected without instructions from the Engineer, he shall make good any resultant damage or defect. All misunderstandings of the Drawings and Specifications shall be clarified by the Engineer.

1.06 WORKMANSHIP AND MATERIALS

- A. Workmanship shall be the best quality and performed by mechanics skilled in their trades. The Contractor shall furnish the services of an experienced superintendent who will be constantly in charge of the erection of the work until completed and accepted. Included in the work shall be proper unloading, installing, connecting, adjusting, starting, and testing of work involved, including equipment and materials furnished by others and the Owner.
- B. Unless otherwise hereinafter specified, all materials and equipment under this Division of the Specifications shall be new, of best grade, and as listed in the printed catalogs of the manufacturer. Each article of its kind shall be the standard product of a single manufacturer.
- C. Whenever the words "or equal", "or equal approved", "equivalent equipment", "acceptable", or other words of similar intent or meaning are used, implying that judgment is to be exercised, it is understood that it refers to the judgment of the Engineer.
- D. The Engineer shall have the right to accept or reject material, equipment and/or workmanship, and determine when the Contractor has complied with the requirements herein specified.
- E. The Contractor shall coordinate with all trades in determining that various phases of work will not interfere with the final efficient operation or use of materials or equipment installed under this Contract. Interference shall be called to the attention of the Engineer before installation is made. The Engineer shall then instruct the Contractor to make such changes and corrections as deemed necessary.

1.07 EQUIPMENT: GENERAL

- A. Manufacturers' published instructions shall be followed in making all installations, erecting, cleaning, and operating of all materials and equipment. Rotating equipment shall be statically and dynamically balanced for minimum vibration and low operating noise level.
- B. Equipment capacities shall not be less than specified or scheduled.
- C. All equipment and major components thereof shall be equipped with a permanently attached nameplate bearing manufacturer's name, address, catalog number and serial number. For equipment installed where exposed to the weather, the nameplate shall be corrosion-resistant metal with information engraved or stamped.
- D. All moving parts, belts, pulleys, and other rotating parts shall be provided with suitable guards or enclosures in accordance with Federal, State, and local regulations.
- E. All equipment to be installed shall be the standard catalog products of the manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall be products which have been in satisfactory use at least three years, unless otherwise accepted by the Engineer.
- F. The installation of any materials and equipment not meeting the specified standards shall be removed and all new materials or equipment meeting the approval of the Engineer shall then be installed at no cost to the Owner.
- G. Design is based on equipment as described in these specifications and equipment schedules. Any change in foundation bases, electrical wiring, conduit, circuit breakers, disconnects, connections, piping, controls, and openings that are required by alternate equipment submitted and accepted shall be the responsibility of the Contractor.
- H. The Contractor shall be responsible for placing equipment or apparatus too large to pass through doors or stair wells, etc. within the building prior to completion of the enclosing structures. Properly protect the equipment from damage from normal construction processes

and/or the elements after installation within the structure.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Materials and equipment shall not be stored at the site until ready for installation or until there is suitable space provided to properly protect equipment from the elements. Equipment shall be delivered and stored in original containers and shall be continuously protected from damage. Any damaged materials or equipment shall be replaced with new equipment or repaired to the satisfaction of the Engineer. Repainting of equipment will be required where damaged in shipment or by improper protection at the site. Rotating equipment stored on the site shall be turned through two full rotations a minimum of once a month.

1.09 SUBSTITUTION OF MATERIALS, FIXTURES & EQUIPMENT

- A. Where equipment is specified by a manufacturer's name and catalog number only, or where a specified manufacturer or manufacturers are named as being acceptable, provided all design and space requirements are met, and subject to acceptance by the Engineer, no substitution or other equipment will be allowed.
- B. Where materials, fixtures, or equipment are specified by manufacturer's name and catalog number, and the words "or equal approved" or similar working is used, such specification shall be deemed to establish style, type, and quality of the equipment required and may include certain desirable technical features. The Contractor may offer, for acceptance, any material, item, or equipment or process which he believes is equal to or better in every respect to that indicated or specified as a substitution, provided it also meets space and capacity requirements.
- C. Any alternate proposal for substitute equipment, or use of equipment not specified by catalog number, shall include all necessary changes and additions to other work occasioned by this substitute equipment. Additionally, each alternate proposal shall stipulate that the substitute product will fit the space allotted to the specified items and will provide equal or greater clearances for services, maintenance and/or removal. The Contractor shall be allowed only one substitution proposal; if the substitute items are not acceptable to the Engineer, the specified items or products shall be installed without change in cost.
- D. Acceptance of a proposed substitution shall not be held to have relieved the Contractor of responsibility for the proper execution of the work, nor from guarantee and maintenance requirements imposed by the Contract Documents. Where no substitutions are proposed or accepted in conformity with the provisions of this article, then no deviation from the material or equipment specified will be allowed.
- E. Unless specifically requested hereinafter, prior approval of substitute items will not be considered by the Engineer during the bidding phase.

1.10 SUBMITTAL DATA AND SHOP DRAWINGS

- A. GENERAL: Three copies each of brochures, shop drawings, and material lists as required by the specifications, shall be prepared and submitted to the Engineer for review within thirty days after award of the Contract. No work indicated on any one shop drawing shall be started until such drawings have been reviewed and accepted by the Engineer.
- B. Space is critical; therefore, equipment of larger sizes than shown, even though of an acceptable manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- C. Where equipment manufacturers named as equivalent or accepted as equal are proposed for use by the Contractor, he shall be responsible to coordinate the change with all trades affected. Contractor shall submit, for acceptance, 1/4 inch scale shop drawings for equipment rooms, plan and section, roof plan, etc.

1.11 PRODUCT DATA

- A. Contractors shall submit complete brochures of all equipment to be installed.

- B. Contractors shall submit a list of all material as specified not covered by brochures or shop drawings.
- C. Submittal brochures shall be indexed by specification section with table of contents, bound in a three ring binder, and identical. Data shall be referenced to section and paragraph numbers of the specifications and to fixture and equipment numbers listed or scheduled, and shall be assembled in numerical order of the specification sections and paragraphs. No consideration will be given to partial submittals. No submittal shall be accepted directly from supply house or manufacturer's representatives nor will substitutions be discussed with anyone other than the successful Contractor after the contract is awarded.
- D. All materials and equipment shall be submitted by manufacturer, trade name, and model number. The submittal shall include data requested in the individual sections. The Contractor shall not assume that applicable catalogs are available to the Architect's or Engineer's office. Maintenance and operating manuals and coded order forms are not suitable submittal material. Each sheet of printed material shall be clearly marked (using arrows, underlining, or circling) to show the particular sizes, types, model numbers, ratings, capacities, and options actually being proposed. Non-applicable material shall be crossed out. All specified features must be specifically noted on the submittal.
- E. Where the item is a substitution, the submittal must be complete with adequate proof of its quality equal to the item specified. Substitutions made because of installation problems, non-availability, later delivery, etc., shall be explained in the transmittal letter accompanying the submittal. Substitute items shall be accepted only under the following conditions: "Should the material or equipment fail or perform unsatisfactorily during the warranty period, this material and/or equipment shall be replaced with material or equipment specified by name in these specifications, at no additional cost to the Owner. Contractor shall PERSONALLY bring a sample of the substitute item to the Engineer office for his inspection at time submittals are made if Engineer requests same."
- F. When items are omitted from the submittal or if submittal is not received by the Engineer within thirty days of Contract date, it shall be construed to mean that only items specified by name and number shall be installed and no substitutions shall be accepted.
- G. In the event that submitted materials, appliances, etc., are not, in the opinion of the Engineer, in conformity with the specifications, the Engineer reserves the right to reject this equipment.
- H. If items other than those specified or approved as submitted are found installed on the project, they shall be removed and the specified items shall be installed at no cost to the Owner.
- I. Submittals shall be reviewed by the Engineer for conformance with design concept only. Review will not include deviations from detail requirements unless these deviations are specifically listed by the Contractor in writing and attached to the data. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements; construction criteria including all means and methods, materials, catalog numbers, and similar data for checking and coordinating with the requirements of the work. Quantities of materials and equipment will not be checked by the Engineer.

1.12 SHOP DRAWINGS

- A. Contract drawings are diagrammatic design drawings and are not intended as installation drawings. Each Contractor shall, within thirty days after award of contract, and prior to beginning any installations, prepare NEW AND ORIGINAL detailed shop drawings for the following:
 - 1. Mechanical Rooms
 - 2. Chiller Installations
 - 3. Ductwork
 - 4. Control Wiring Diagrams
 - 5. Interlock Wiring Diagrams
 - 6. Kitchen Plumbing Rough-Ins,

7. and other critical spaces as directed by the Engineer, showing the exact location and dimensions, spacing and location of each piece of equipment and piping. Reproduction of Engineer's design drawings shall not be considered as shop drawings.
- B. The Contractor shall coordinate to ascertain that there are no conflicts. The Contractor is responsible for rearrangement and revision required to dimensions, connection sizes, special installment requirements, horsepower, voltage, and phase of all equipment.
- C. Each trade, in cooperation with all other trades, shall determine, prior to commencing work, the sequence of the installation of all trades.
- D. In no case will wire to wire or terminal type of wiring diagrams for control system be included or checked as submittal; they shall be included as information only. Temperature control function diagram and written description only shall be accepted by the Engineer.
- E. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements, construction criteria including means and methods, and materials and necessary coordination data for making all installations complete and operating to the full intent of the Contract Drawings and Specifications.
- F. Shop drawings shall be submitted to and approved by the Engineer prior to beginning of any installations. The Engineer will assist in resolving installation problems and conflicts only when furnished with complete shop drawings prepared by the Contractor for all phases of the work and only when the Contractor cannot solve a problem. When installations are made without submitting shop drawings, the Contractor is responsible for immediate correction at his own cost for conflicts and to installations contrary to the intent of design drawings.

1.13 CONSTRUCTION RECORD DRAWINGS

- A. Each Contractor shall purchase or obtain from the Architect/Engineer one complete set of final design documents of the Contract Drawings and shall record on these drawings all locations, dimensions, and depths of all buried and concealed piping and conduits, plugged outlets, and equipment. The master copy shall be maintained at the job site at all times and shall be marked daily as construction progresses. These drawings shall not be used for reference or construction but shall be available for the Engineer's review. No backfilling of trenches will be permitted until Record Drawings are approved as up-to-date.
- B. Depth of sewers and other underground piping prints shall be from a permanent bench mark which shall be shown on drawings.
- C. At completion of the work, the data on these prints shall be given to the Engineer of record and transferred electronically to CAD drawing format. The electronic files shall then be copied to a CD for reproducible prints by the Contractor or building Owner, dated, marked "Record Drawings".

1.14 MANUFACTURER'S INSPECTION

- A. At the completion of work and before acceptance, an authorized representative of the manufacturers of mechanical and electrical equipment shall personally inspect the installation and operation of his equipment to determine that it is properly installed and in good operating order. If equipment is to be concealed, the representative shall make his checks during the course of installation. The Contractor shall submit to the Engineer a statement signed by each manufacturer's accordance with the manufacturer's recommendations and is operating properly.
- B. Inspection shall include new air conditioning equipment, special systems, and such items as are specifically designated by the Engineer.

1.15 TESTING LABORATORY CERTIFICATION

- A. All equipment and materials where applicable shall be listed by Underwriters' Laboratories and shall bear the Underwriters' Laboratories label.
- B. All material, equipment, products furnished and installed on this project shall bear the label, symbol and other identifying mark of a nationally recognized testing laboratory that maintains

periodic inspection of production of labeled and/or listed equipment or material and whose listing of labeling states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner, when such label, symbol, or listing is available.

1.16 FIRE AND SMOKE DEVELOPMENT RATINGS OF MATERIALS

- A. All materials and products installed on this project shall have published fire and smoke developed ratings that conform with U.L. classifications and NFPA 90A and shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less and a fuel contribution rating of 50 or less.

1.17 ASBESTOS

- A. No product which contains asbestos shall be incorporated into any component of this Project.
- B. If asbestos is encountered in any existing installations, Contractor shall stop work immediately and notify the Owner. No work shall be commenced in the area containing asbestos until complete removal or abatement has been accomplished by Owner.

1.18 EXISTING UTILITY PIPING

- A. The drawings indicate all known utility and drainage piping existing on the site of the work. Location of said piping is in accordance with information furnished to the Engineer by the Owner. Responsibility for locating, uncovering, disposing, or maintaining all existing utility piping shall rest solely with the Contractor, who shall plan and conduct his operations in such a manner to insure safe conditions for the entire construction period.
- B. Existing underground piping shall be maintained in service unless otherwise noted. Contractor shall promptly repair all utility piping to be maintained in service, at no expense to the Owner, in the event that they are damaged as a result of his work of this project. All valve boxes, manholes, or other appurtenances of utilities which are to remain in service shall be raised or lowered to meet new finished grades as indicated on appropriate drawings.
- C. Make arrangements for connections to utilities required for the work as shown on drawings and pay all charges and fees in connection with any service connections, making installations complete in all aspects.
- D. Each Contractor shall furnish and install all materials, equipment, and labor required for finished, complete, and operating service connections. Contractors shall be responsible for making personal contact with proper officials of utility companies prior to bid opening and obtaining all details of service requirements and for including ALL costs for ALL requirements for complete services.
- E. Any detail requirements for utility metering and/or connections is specified hereinafter in the appropriate section.
- F. Existing utility piping which is to be abandoned shall be completely removed where it occurs in the area of excavation. Abandoned piping shall be plugged or capped in a manner acceptable to the Engineer. Existing manholes shown to be abandoned shall be filled with sand.
- G. Any minor adjustment in location or alignment of new work to avoid or to connect to existing utilities shall be performed as directed by the Engineer without additional cost to the Owner.

1.19 INTERRUPTION OF SERVICES

- A. While work is in progress, except for designated short intervals when connections are to be made, continuity of service shall be maintained to all existing systems. Time and duration of interruptions shall be coordinated with the Owner. The Contractor shall be responsible for any interruptions to service and shall repair any damages to existing system caused by his operations.
- B. Existing air conditioning, plumbing, and special systems serve vital operations. These vital operations include providing for the general health and welfare of the building. To satisfy these requirements, all interruptions of service must be held to an outage time of four hours, unless

otherwise approved by the Owner.

- C. Coordination of such outages shall result from a written request to the Superintendent of Construction who will indicate the permissible times for outages. Request shall be submitted at least 72 hours prior to outage time requested.

1.20 EXCAVATION AND BACKFILL

- A. Provide all excavation and backfill required for work of this section, in accordance with applicable requirements of Division 31 - Earthwork Section. Coordinate disposition of building materials to avoid interference with all other work.
- B. Provide barricade protection and shoring as required for safety.
- C. Do not backfill until after testing and inspection of installed pipe work.
- D. All plants, turf, and surfacing that occur in the areas of the excavation shall be carefully removed and placed where they will not be damaged. After the excavations are filled, the plants, turf, and surfacing shall be replaced as directed. All sidewalks, driveways, or other cement or asphalt surfaces which are damaged during excavating shall be repaired to match the adjacent work in material and finish and in accordance with requirements established by authorities having jurisdiction over subject walks, lawns, or streets.
- E. Provide clearance (12 inches minimum) under suspended piping and ductwork under the building. The Contractor shall be responsible for necessary excavation to obtain such clearance and if such clearance is not found to exist at the completion of the project, the Contractor shall excavate as required to meet this specification.
- F. Piping trenches not under the building shall be parallel to building lines unless otherwise noted on drawings.
- G. Trenches shall be cut a minimum of six inches (6") below required depth to allow for bedding material. The bottoms of sewer trenches shall be accurately graded to best secure all available fall. Sewer and water pipes shall be laid in separate trenches. All piping shall have a minimum cover of 24 inches unless otherwise noted or accepted. Trenches shall be a minimum of SIX inches (6") wide and not less than FOUR inches (4") wider than outside diameter of a single pipe or conduit being installed. When more than one pipe is installed in a trench, the trench shall be widened appropriately to allow the pipe to be laid side-by-side with a minimum of FOUR inches (4") of sand between each pipe. In no case shall different services be installed one above the other. Piping and/or conduit of various trades shall NOT be installed in same trench unless permission is granted by the Engineer. Where required by depth and/or type of soil, trenches shall be properly and adequately shored to prevent cave-ins and slides.
- H. Properly backfill, flood, and tamp all excavations to the finished grade AFTER the piping has been observed and accepted. The backfill for all pipe may be excavation material, except that at least six inches (6") of clean pit run sand shall be placed over the pipe and six inches (6") of sand below the pipe. A minimum of 12 inches of sand is required for all piping including sewer. Backfill shall be placed in six inch (6") layers, wetted and compacted to the density of adjacent soil. Continue this process until trenches are completely backfilled. Surplus materials shall be hauled from the project. Where trench backfill settles below finished grade during the one year guarantee period, the Contractor shall take necessary steps to correct same as accepted by the Engineer.
- I. Trenches backfilled prior to observation of piping or conduit by the AHJ shall be reopened as directed by the AHJ.

1.21 OPENINGS: CUTTING, REPAIRING

- A. Holes in Concrete: Sleeves shall be furnished, accurately located, and installed in forms before pouring of concrete. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the acceptance of the Structural Engineer prior to cutting or drilling. No cutting or boring of structural members shall be done without WRITTEN permission of the Structural Engineer.

- B. Verify that all chases and openings are properly located.
- C. Damage to existing facilities shall be repaired as required to restore these facilities to their original condition. All openings through floor, ceilings, walls, etc., shall be sealed rat and insect-proof, whether exposed to view or within walls, with a fire resistant sealant.

1.22 CONCRETE WORK

- A. Provide concrete equipment bases for pumps, air handling units, chillers, boilers, etc. Provide anchors, thrust blocks, and all piping supports in trenches.
- B. Furnish all required templates for anchor bolts and dimension drawings for housekeeping pads. All concrete shall be in accordance with that specified under Division 03 - Concrete of the Specifications.

1.23 MANNER OF RUNNING PIPE AND CONDUIT

- A. All pipe and ducts (except gas), shall be concealed in chases, walls, furred spaces, or above the ceilings unless otherwise noted.
- B. In mechanical/electrical rooms, janitor's closets, or other storage spaces, where necessary, piping may be run exposed. Exposed piping shall be run in the neatest, most inconspicuous manner and parallel to building lines. Piping shall be run high as possible when exposed in rooms.
- C. No piping or duct shall be installed in structural concrete slabs, beams, walls, or concrete structure without prior approval unless specifically noted on the drawings.

1.24 EQUIPMENT AND CONNECTIONS

- A. All apparatus, equipment, devices, and appliances which are indicated to have pipe connections shall be so equipped. Each such mechanical connection shall be valved and/or trapped.

1.25 MOTORS AND CONTROLS

- A. Unless noted to the contrary, motors of one horsepower and larger shall be three phase with voltage compatible with the building electrical system. Motor sizes shown on drawings are minimum acceptable sizes.
- B. Motors less than one horsepower shall be 115 volts or 200/230 volts, single phase, with built-in thermal protection and shall be furnished with manual or magnetic starters as required, unless otherwise noted on drawings.
- C. The Contractor shall furnish a suitable motor starter with the necessary number of auxiliary contacts required for the use with the proper type of switch controls in the cover. Motor starters shall be equal to Furnas, Siemens, General Electric, Cutler-Hammer, or Square D, with three leg overload protection; except special requirements for motor starters shall be specified under the particular piece of equipment requiring starter. Mounting of motor starters and wiring shall be installed under Electrical Division.

1.26 ELECTRICAL WIRING OF TEMPERATURE CONTROL EQUIPMENT

- A. The Contractor shall be responsible for complete installation of all the automatic temperature control wiring. All power wiring, interlock wiring as required, starter connections, and disconnect switches shall be installed under Electrical Division. Control wiring shall be a minimum of No. 18 AWG and shall be copper with THW or THWN-THHN insulation. Control wiring shall be installed in EMT conduit when above grade, PVC when below. See applicable section for conduit specifications.
- B. Contractor shall provide necessary wiring diagrams showing power wiring, interlock wiring, and temperature control wiring which shall be used for making the control wiring and interlock wiring installations.
- C. At the completion of all construction work, there shall be a meeting at the job site of all parties involved, who shall inspect, test, and check each control circuit, interlock circuit, and power

circuit for all equipment and shall determine by mutual agreement that all equipment is properly wired for the operations intended. A letter to this effect, signed by all three parties, shall be furnished to the Engineer at the time of final inspection. This letter shall read as follows:

1. "We, the undersigned authorized representatives of the Contractor, hereby certify that we have met together at the site and have by test and check found that entire temperature control system and interlock wiring systems are properly installed and wired and all items are functioning in accordance with design requirements and Contract Drawings and Specifications."

1.27 CLEAN-UP

- A. All unused material and debris resulting from the performance of work shall be removed from the premises as it accumulates.

1.28 HOISTING, SCAFFOLDING, AND TRANSPORTATION

- A. Furnish hoisting facilities to set materials and equipment in place and provide scaffolding, ladders, and facilities for equipment installations and for adjustment and balancing, installation of grilles, and cleaning of fixtures and devices. Provide transportation to deliver materials, equipment, tools and labor to perform the work.

1.29 SLEEVES FOR ALL PIPES AND CONDUITS

- A. For pipes through outside walls above grade, install Schedule 40 GALVANIZED steel pipe sleeves having an inside diameter of 1-1/2 inches greater than the outside diameter of piping being installed. Sleeves shall be flush with each wall surface.
- B. Where pipes pass through floors not on fill, 22 gage GALVANIZED sheet metal sleeves shall be used. In concrete floors they shall extend one inch above the floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least one inch (1") greater than outside diameter of insulation. Sleeves shall be set before concrete is poured.
- C. Sleeves in footings, grade beams, under sidewalks, drives, and elsewhere noted on drawings shall be Schedule 40 PVC plastic pipe with chemical weld joints. Use long sweep ells where pipe turns are made.
- D. Where pipe passes through a concrete wall, beam, or floor below grade or below ground water level, a through-wall or floor seal shall be installed. Sealing fitting shall be installed in concrete forms before concrete is poured. Fitting shall be O.Z. Gedney Type FSK where sealing is required on one side of wall only and Type WSK where sealing on both sides of wall is required. Installation shall be in accordance with manufacturers' instructions.
- E. The annular space around piping and sleeves shall be filled with a fire resistant sealant as specified hereinafter. Both sides of wall, floor, ceiling, or roof shall be sealed to the satisfaction of the Engineer whether exposed to view or within walls. ALL openings around pipe shall be insect, vermin, and rodent proof.

1.30 ROOF PENETRATIONS AND FLASHINGS

- A. Refer to Specification Division 07 - Thermal and Moisture Protection.

1.31 SEALING OF PENETRATIONS (FIRE STOPPING)

- A. Seal all small openings in floors, walls, ceilings, etc. around pipe, etc. with Dow Corning Fire Stop Sealant System, 3M Fire Barrier 2000+ Silicone Sealant Systems, or approved equal, in conformance with U.L. testing procedures.
- B. Seal all openings larger than 1/4" around pipe, duct, etc., through roof, walls and floors above grade with a two-part foam, or one-part sealant material approved by the Engineer, at least 1-1/2" thick, that will form a watertight, vermin-tight barrier that is capable of containing smoke and fire up to 2000 deg. F. for two hours. Fire and smoke barrier will be required in all floors above grade of multi-story buildings and in all walls of fireproof construction. All empty holes and all large openings around pipe, etc., shall also be filled with two-part fire stopping materials. One-part may be used for single penetrations at plumbing fixtures, sleeves, and fire rated expansion joints.

- C. The firestopping system shall be materials that expand to fill cavities or provide adhesion to substrates, and that will maintain seal under normal expected movement of substrates. MATERIAL SHALL NOT REQUIRE A RISE IN TEMPERATURE TO INSTALL OR ACTUATE THE SEAL. Fire Stop Systems shall utilize materials that are UL Classified as "Fill, Void, or Cavity Materials" and "Through Penetration Firestop Systems." Materials shall have been tested in accordance with ASTM E814 "Methods for Fires Tests of Through-Penetration Firestops" and UL 1479 "Fire Tests of Through-Penetration Firestops."
- D. Mineral fiber board, mineral fiber matting and mineral fiber putty may be used as forming and damming for the foam and may be left in place as an integral part of the seal if of a fire rated material. Plywood, particle board, or other combustible foaming and damming materials shall be removed after foaming is completed.
- E. Foam exposed in finished areas shall be neatly trimmed flush with the finish surface. In traffic areas, foam sealed areas shall be covered with a traffic surface approved by the Architect.
- F. Application of foam in penetrations shall be made in accordance with the manufacturer's recommended procedure. Upon completion of the installation, the openings around all penetrations shall be airtight to prevent passage of water, smoke, fire or vermin. Proper installation shall be verified by proper color change and cell structure of cured foam.
- G. Damming materials shall be removed after foam has cured for 24 hours if of other than fire sensitive materials. Seal all voids that have developed in foam with Dow Corning RTV sealant as required to provide full coverage.
- H. Inspect penetration seals after 24 hours and inject additional foam where required for a tight seal. Reinspect after added foam has cured 24 hours. Cut and trim cured foam with sharp knife as required for finished appearance.
- I. Nelson Flameseal Putty, Flamemaster (Flamastic 77), and Thomas & Betts Flamesafe Fire Stop System may be acceptable products for sealing of penetrations provided they are installed according to manufacturer's recommendations and are approved by the Engineer prior to installation.

1.32 FLOOR AND CEILING PLATES

- A. Furnish and install chromium plated escutcheon plates around pipes passing exposed through walls, floors, or ceilings. Plates shall be sized to fit outside of pipe or sleeves and/or insulation and shall fit snugly. Plates shall fit around sleeves where they extend through the floor. Solid chromium plated plates with set screws shall be installed on any piping where split ring or compression type plates will not stay in position.
- B. Where ducts pass through walls, floors, or ceilings, install sheet metal collars to cover the void around the duct where fire barrier is not required.
- C. Escutcheons of galvanized steel shall be installed on all steel or aluminum flue vent pipes.

1.33 TESTS AND ADJUSTMENTS

- A. No piping work, fixtures, or equipment shall be concealed or covered until they have been observed by the Engineer, who shall be notified a minimum of 48 hours in advance. All work shall be completely installed, tested as required by this section and the City and State Ordinances, and shall be repeated upon request to the satisfaction of the Engineer's representative.
- B. All domestic water piping shall be flushed out, tested at 150 psi and shall be left under pressure of the supply main or a minimum of 40 PSI for the balance of the construction period.
- C. Piping tests shall be made with the medium and under pressures listed below:

1.34 TEST

- A.

TYPE OF SYSTEM	GAGE PRESSURE (Lb/sq.in. or vacuum in inches)	TEST MEDIUM
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Soil, Waste, and Vent piping with Bldg. including Rain Water leaders and Storm Drains	Minimum of 10 feet head in excess of ultimate pressure for 4 hrs. min, with no loss in head.	Water
Domestic Hot and Cold Water	150 PSI: 24 hours	Water
	15" HG: 2 hours	Air
Gas: Low Pressure (Less than 12" HG)	125 PSI: 8 hours	Air
Gas: High Pressure	Twice reduced pres. but not less than 50 PSI	Air
Compressed Air	125 PSI: 24 hours	Air
Vacuum	150 PSI: 24 hours	Nitrogen
Oxygen		Air or Water
Steam: To 15 PSI	100 PSI: 24 hours	Air or Water
Steam: 16-100 PSI	150 PSI: 24 hours	Air or Water
Steam: 100-250 PSI	300 PSI: 24 hours	Air or Water
Steam Condensate	150 PSI: 24 hours	Air or Water
Chilled and Hot Water	100 PSI: 24 hours	Air or Water
Condenser Water	100 PSI: 24 hours	

1. NOTE: Additional tests may be required as specified in each Section of these Specifications.

- B. Test gages shall have been calibrated for accuracy within three (3) months of date tests are made. Evidence of calibration shall be available to Engineer upon request.
- C. Test gages shall have a range such that the test pressure will fall at mid-range of dial.
- D. For remodel projects, test medium shall be the same substance as that being used in the system.
- E. Test Procedures shall be applied for minimum periods noted and until tests are complete.
- F. Final pressures at end of test period shall be no more or less than that caused by expansion or contraction of the test medium due to temperature changes.
- G. Check of systems during application of test pressures shall include visual check for water medium leakage, soap bubble, or similar for air and nitrogen medium.
- H. During heating and cooling cycles, linear expansion shall be checked at all elbows, U bends, expansion joints, etc., for proper clearance.
- I. The Engineer shall be notified 48 hours prior to each test and other specification requirements requiring action by the Engineer. All tests shall be made in presence of the City Inspector and Engineer's representative.
- J. Maintain written logs of all tests specified above.

1.35 OPERATION TEST

- A. At completion of installations, Contractor shall operate all mechanical and plumbing systems for a period of at least two days of eight hours each to demonstrate fulfillment of the requirements of the Contract. During this time, all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Engineer.

1.36 FINAL OPERATION AND INSTRUCTION

- A. Upon completion of the installation of the equipment and after final acceptance, and on Engineer's request, the Contractor shall place a competent person at the building who shall operate the plant for a period of one eight hour day, instructing the Owner in all details of operation and maintenance. This requirement is in addition to "Operation Test" specified above.
- B. Any required instructions from manufacturer's representatives shall be given during this period. The time specified under "Operation Test" will not substitute for the one day of final operation and instruction.

1.37 OPERATION

- A. The Owner may require operation of parts of all of the installation for beneficial occupancy prior to final acceptance.
- B. Cost of utilities for such operation shall be paid by the Owner. Said operation shall not be construed as acceptance of the work; however, Contractor shall obtain written agreement with Owner regarding beginning date for warranty and guarantee purposes. Unless such agreement is obtained, warranties and guarantees shall go into effect upon completion.

1.38 DAMAGE BY LEAKS

- A. The Contractor shall be responsible for damages to the grounds, walks, roads, buildings, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping system installed by this Contractor as a part of this Contract. He shall repair, at his expense, all damage so caused. All repair work shall be done as directed by the Engineer.

1.39 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibilities during the Contract period.

1.40 REQUIREMENTS FOR FINAL ACCEPTANCE OF PROJECT

- A. All of the following items must be completed prior to final acceptance of project. No exceptions will be made and no final acceptance of payment will be made until all items are completed.
 - 1. **CLEANING EQUIPMENT AND PREMISES:**
 - a. Thoroughly clean all parts of the piping, valves, and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease; adhesive labels, and foreign materials shall be removed. Surfaces shall be carefully wiped.
 - b. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.
 - c. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves, and similar items shall be thoroughly cleaned.
 - d. Gas, air, and oil piping shall be blown out with clean compressed air or inert gas.
 - e. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of the work.
 - 2. **DEFICIENCY LISTS:** Correct all deficiencies listed at time of Substantial Completion.
 - 3. **OWNER'S OPERATING AND SERVICE MANUAL:** Submit, at least ten days prior to Final Acceptance, one copy of the Owner's Manual to the Engineer for his acceptance. Following the Engineer's acceptance, prepare three copies of bound, indexed, Owner's Manual to be delivered at time of Final Acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System piping and valving diagram.

- c. System control drawings.
- d. System interlock drawings.
- e. System maintenance instructions.
- f. Material and equipment lists.
- g. Serial numbers of all principal pieces of equipment.
- h. Manufacturer's, suppliers', and subcontractors' names, addresses, and telephone numbers; both local representatives and manufacturers' service headquarters.
- i. Equipment operating and maintenance instructions and parts lists.
- j. Certified performance curves.
- k. Manufacturer's certification.
- l. Balancing and performance test report.
- m. Oiling, lubrication, and greasing data.
- n. Complete electrical load data from operation test.
- o. Belt sizes, types and lengths.
- p. Valve chart.
- 4. INSTRUCTIONS:
 - a. All verbal instructions as herein specified shall have been performed.
 - b. Provide the following:
 - 1) System operating instructions.
 - 2) System piping and valving diagram.
 - 3) System control drawings.
 - 4) System interlock drawings.
- 5. CERTIFICATIONS: Provide three bound copies containing the following:
 - a. Balancing and Performance Test Report.
 - b. Manufacturer's certifications.
 - c. Contractor's guarantees.
 - d. Owner's acknowledgment of receipt of instruction, enumerating items in Owner's Manual. List of manufacturers' guarantees executed by the Contractor (those extending beyond one year.)
- 6. RECORD DRAWINGS: Deliver the specified record drawings to the Engineer.
- 7. Furnish the services of an Engineer or Technician acceptable to the Engineer to instruct the Owner's authorized representative in the complete and detailed operation of each and every system and piece of equipment. Instructions shall be conducted for the period of time necessary to thoroughly familiarize Owner's personnel and to accomplish the desired results. Upon completion of these instructions to the Owner, provide a letter to the Owner signed by him stating dates and names of personnel giving instruction and those receiving instruction. NOTE: One copy of these letters shall be included in data to be furnished for final acceptance and shall be sent directly to the Engineer.

1.41 GUARANTEES AND WARRANTIES

- A. The Contractor shall guarantee to the Owner that all labor, materials furnished, and work performed are in accordance with the contract, contract drawings, specifications, authorized alterations, and additions. Should any defect develop during the contract guarantee period due to improper materials, workmanship, or arrangement, the same together with any other work affected in correcting such defect shall be made good by the Contractor without expense to the Owner.
- B. The materials and equipment shall be warranted to be free from defects by the manufacturer. Any defect that develops or failure that occurs during the contract guarantee period together with any other work affected in correcting such defect or failure shall be made good by the Contractor without expense to the Owner. Manufacturer and Contractor shall include cost of labor in the warranty of all equipment.
- C. The contract guarantees and warranty periods shall be from the date the complete facility is accepted by the Owner, unless other dates are mutually agreed upon between Owner and

Contractor.

- D. The Contractor's work shall be guaranteed for a minimum of one year unless noted otherwise in specific sections of these specifications.
- E. The materials and equipment shall be warranted for a minimum of one year. Some components may be specified with or normally have longer standard warranty periods. In this case, the longer warranty period shall be provided by the Contractor.

1.42 DEMOLITION AND RELOCATION (WHERE APPLICABLE)

- A. The Contractor shall remove and/or relocate, modify, or reinstall all items as indicated on drawings or required by the installation of new materials, equipment, and outlets. All removal and/or salvage and all materials and equipment shall remain the property of the Owner and shall be stored at such locations on site as designated by the Owner.
- B. All waste, trash, debris and other such unusable items shall be promptly removed from the site and disposed by the Contractor.
- C. All items of equipment to be relocated shall be thoroughly cleaned, inspected, and reinstalled in a proper manner by workmen skilled in the trade and in conformance with standard practice of trade involved. Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore item to good operation. Should equipment designated for relocation be found to be damaged and/or unsuitable for relocation, it shall be called to the attention of the Engineer prior to dismantling for further instructions before removal. Items damaged during removal and/or storage are the responsibility of the Contractor and shall be replaced or repaired by him in a manner acceptable to the Owner. After reinstallation, items shall be "fire-tested" and/or given operational tests and put back into proper working order. Service piping and/or wiring to items to be removed or relocated shall be removed to points at which reuse is to be continued or service is to remain. Services not reused shall be capped, sealed, or otherwise cut-off or disconnected in a safe manner acceptable to the Owner and shall be done in such a manner to result in a minimum of interruption to services of adjacent occupied areas. Services to existing occupied areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specified acceptance of the Owner and a time schedule accepted by him for the cut-off period.
- D. The Contractor shall be responsible for the loss or damage of existing facilities caused by him or his workmen and shall be responsible for repairing all damage and the replacement of such losses. The Contractor shall erect such temporary barricades, with necessary safety devices as required, to protect working personnel and/or others from injury and shall remove such temporary protection upon completion of the project. Where existing construction is removed to provide working access to existing utilities and where partitions, walls, floors, and ceilings are removed, the Contractor shall remove and reinstall in locations accepted, all devices required for the complete final system in each and every respect. Contractor shall provide temporary service facilities to all equipment which must remain in operation during the construction period and shall make such necessary arrangements, send proper notices, and perform all such services as required to maintain in service operation all plumbing, air conditioning and ventilation systems in all new and existing areas as required for the continuing operation of the facility being remodeled.
- E. The Contractor shall be responsible for proper operation of existing facilities in the existing buildings after water or gas services have been cut off and/or systems have been drained for necessary changes or additions to systems. The Contractor shall check all flush valves and other water consuming devices and shall clean and service any items which are malfunctioning due to dirt or trash entering pipe. Any stuck flush valves shall be serviced. The Contractor shall survey entire area where gas is cut off and shall relight all pilots on all equipment upon restoration of gas and shall restore all gas fired equipment to normal operation.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

PART 4 COORDINATION

4.01 EMBEDS AND BLOCKOUTS

- A. All trade Contractors requiring any embedded items to be cast into the precast concrete wall panels shall review the wall panel shop drawings and indicate the exact location and piece mark of the embedded item on the panel elevations. These items include, but are not limited to: hollow metal door frames, channel frames, steel plates, sleeves, blockouts, conduit, junction boxes, and any other equipment required by other trades. The wall panel shop drawings shall be reviewed and returned to the precast panel manufacturer with cut sheets and any special instructions pertinent to the placement of the embedded items.
- B. All openings and embeds required for proper installation of Contractor's equipment not shown on shop drawings marked up by Contractor shall be provided by responsible Contractor at no additional cost to the project.

4.02 DELIVERY AND INSTALLATION

- A. All trade Contractors shall furnish and deliver any embedded items required for their trade to the precast plant manufacturer. These Contractors shall have a technician present at the precast manufacturing plant to supervise this work at no charge to the precast manufacturer.

4.03 SCHEDULE

- A. The review and return of the embed placement submittal drawings and the delivery of embedded items shall be done in a timely manner that will not delay the production schedule of the precast manufacturer. Any item not delivered in time for casting into the wall panels shall be rectified by the trade requiring that item at their expense. In a case where embedded items are not delivered in time for casting into a wall panel, the precast manufacturer shall provide a blockout based on sizes furnished by the trades requiring them.

END OF SECTION

**SECTION 22 0516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Pipe loops, offsets, and swing joints.

1.02 REFERENCE STANDARDS

- A. EJMA (STDS) - EJMA Standards; Tenth Edition.
- B. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Design Data: Indicate selection calculations.
- D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.
- E. Maintenance Data: Include adjustment instructions.

PART 2 PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Inner Hose: Stainless steel.
- B. Exterior Sleeve: Double braided, stainless steel.
- C. Pressure Rating: 125 psi up to 12 inch.
- D. Joint: Flanged or Threaded with union.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/4 inch on each side of installed center line.

2.02 ACCESSORIES

- A. Pipe Alignment Guides:
 - 1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

- E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- G. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water meters.
- B. Flow meters.
- C. Pressure gauges.

1.02 REFERENCE STANDARDS

- A. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.
- C. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 WATER METERS

2.02 FLOWMETERS

- A. Flow Sensing Element.
 - 1. In-Line Averaging Measuring Station: Type 316 stainless steel pitot type flow element inserted through welded threaded couplet, with safety shut-off valves and quick coupling connections, and permanent metal tag indicating design flow rate, reading for design flow rate, metered fluid, line size, station or location number.
 - a. Pressure rating: 275 psi.
 - b. Maximum temperature: 400 degrees F.
 - c. Accuracy: Plus 0.55 percent to minus 2.30 percent.
 - 2. Portable Meter: Dry single diaphragm type pressure gauge with 6 inch dial pointer, stainless steel wetted metal parts, variable pulsation damper, equalizing valve, two bleed valves, and master chart for direct conversion of meter readings to flow rate, mounted in rust-proof carrying case with two ten foot long rubber test hoses with brass valves or quick connections for measuring stations.

2.03 PRESSURE GAUGES

- A. Bourdon Tube for Liquids and Gases:
 - 1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.
 - 2. Size: 3-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: Two percent.
 - 4. Scale: Psi.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.
- B. Install water meters with inlet and outlet isolation valves in compliance with AWWA M6.
- C. Install gage taps in piping.
- D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

- E. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
- F. Locate test plugs adjacent thermometers and thermometer sockets, adjacent to pressure gages and pressure gage taps, adjacent to control device sockets.

3.02 SCHEDULES

- A. Pressure Gages.
 - 1. Pumps.
 - 2. Expansion tanks.
 - 3. Pressure tanks.
 - 4. Standpipe, highest points.
 - 5. Standpipe and sprinkler water supply connection.
 - 6. Sprinkler system.
 - 7. Pressure reducing valves.
 - 8. Backflow preventers.
- B. Pressure Gauge Tappings, Location:
 - 1. Control valves 3/4 inch & larger - inlets and outlets.
 - 2. Major coils - inlets and outlets.
- C. Stem Type Thermometers:
 - 1. Headers to central equipment.
 - 2. Coil banks - inlets and outlets.
 - 3. Heat exchangers - inlets and outlets.
 - 4. Boilers - inlets and outlets.
 - 5. Chiller - inlets and outlets.
 - 6. Water zone supply and return.
 - 7. After major coils.
 - 8. Domestic hot water supply and recirculation.
- D. Thermometer Sockets, Location:
 - 1. Control valves 1 inch & larger - inlets and outlets.
 - 2. Unit heaters - inlets and outlets.
- E. Dial Thermometer Location:
 - 1. Each supply air zone.
 - 2. Outside air.
 - 3. Return air.
 - 4. Mixed air.
- F. Static Pressure and Filter Gages.
 - 1. Built up filter banks.
 - 2. Unitary filter sections.

END OF SECTION

SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ball valves.
- B. Butterfly valves.
- C. Check valves.
- D. Gate valves.
- E. Globe valves.
- F. Lubricated plug valves.

1.02 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 0719 - Plumbing Piping Insulation.
- C. Section 22 1005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

- A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding; 2017.
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
- C. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017.
- D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- E. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016).
- F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
- G. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- H. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- I. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008).
- J. MSS SP-67 - Butterfly Valves; 2017.
- K. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.
- L. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.
- M. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

- N. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011.
- O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- P. NSF 61 - Drinking Water System Components - Health Effects; 2019.
- Q. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.05 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Company must specialize in manufacturing products specified in this section, with not less than three years of experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 - 4. Secure check valves in either the closed position or open position.
 - 5. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - 2. Store valves in shipping containers and maintain in place until installation.

1.08 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
- D. Valve-End Connections:
- E. General ASME Compliance:
- F. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- G. Valve Bypass and Drain Connections: MSS SP-45.

H. Source Limitations: Obtain each valve type from a single manufacturer.

2.02 BRASS, BALL VALVES

- A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
 - 1. Comply with MSS SP-110.
 - 2. CWP Rating: 200 psi.
 - 3. Body: Forged brass.
 - 4. Seats: PTFE.
 - 5. Stem: Brass.
 - 6. Ball: Chrome-plated brass.
 - 7. Operator: Handle.
- B. Two Piece, Full Port with Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. Body: Forged brass.
 - 4. Seats: PTFE.
 - 5. Stem: Brass.
 - 6. Ball: Chrome-plated brass.

2.03 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style; Bi-directional dead-end service without use of downstream flange:
 - 1. Class 125 or Class 150 flanges.
 - 2. Comply with MSS SP-67, Type I.
 - 3. Lug Style, Service Pressure Ratings:
 - a. 100 psi for sizes 14 to 24 inch.
 - b. 150 psi for sizes 2 to 12 inch.
 - c. Vacuum down to 29.9 in-Hg.
 - 4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
 - 5. Stem: One or two-piece stainless steel.
 - 6. Seat: EPDM.
 - 7. Disc: Stainless steel.
 - 8. Finish: Epoxy coated.
 - 9. Operator: Gear operator with handwheel over direct-mount actuator base.

2.04 BRONZE, SWING CHECK VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125: CWP Rating: 200 psig (1380 kPa).
 - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. Body: Bronze, ASTM B62.
 - 4. Ends: Threaded or soldered as indicated.
 - 5. Disc: Bronze.

2.05 IRON, PLATE TYPE CHECK VALVES

- A. Class 125 Single-Plate:
 - 1. Comply with API STD 594.
 - 2. CWP Rating: 200 psi.
 - 3. Design: Wafer, spring-loaded plate.
 - 4. Body: ASTM A126, gray iron.
 - 5. Resilient Seat: EPDM.

2.06 BRONZE GATE VALVES - UP TO 3"

2.07 IRON GATE VALVES - 2" AND LARGER

- A. OS & Y:
 - 1. Pressure and Temperature Rating: MSS SP-70, Type I.
 - 2. Body: ASTM A126, gray iron with bolted bonnet.
 - 3. End Connections: Flanged.
 - 4. Trim: Bronze.
 - 5. Disc: Solid wedge.
 - 6. Packing and Gasket: Asbestos free.

2.08 BRONZE, GLOBE VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.09 IRON, GLOBE VALVES

- A. Class 125 and Class 250:
 - 1. Class 125, WOG Rating: 200 psi.
 - 2. Class 250, WOG Rating: 500 psi.
 - 3. Comply with MSS SP-85, Type I.
 - 4. Body: Gray iron; ASTM A126, with bolted bonnet.
 - 5. Connection Ends: Flanged.
 - 6. Trim: Bronze.
 - 7. Packing and Gasket: Asbestos free, adjustable.
 - 8. Operator: Handwheel or chainwheel.
 - 9. Pressure and Temperature Rating: ASME B16.1.

2.10 LUBRICATED PLUG VALVES

- A. Regular Gland with Flanged Ends:
 - 1. Comply with MSS SP-78, Type II.
 - 2. Class 125: CWP Rating: 200 psi.
 - 3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
 - 4. Pattern: Regular or short.
 - 5. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

- D. Install check valves where necessary to maintain direction of flow as follows:
1. Lift Check: Install with stem plumb and vertical.
 2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

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**SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Materials for Metal Fabricated Supports: Comply with Section 05 5000.
 - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
 - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect or Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect or Engineer, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners according to manufacturer's recommended torque settings.
- K. Remove temporary supports.

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Schedules:
 - 1. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - 2. Detail proposed component identification data in terms of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - 3. Valve Data Format: Include id-number, location, function, and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: Black.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Light Contrasting Color.

2.03 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- B. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.
- C. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.
- E. Identification Scheme, ASME A13.1:
 - 1. Primary: External Pipe Diameter, Uninsulated or Insulated.

2. Secondary: Color scheme per fluid service.
 - a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 1. Plumbing Equipment: Yellow.
 2. Plumbing Valves: Green.
 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

**SECTION 22 0719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible elastomeric cellular insulation.
- B. Glass fiber insulation.
- C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Firestopping per Division 7.
- B. Painting insulation jacket per Division 9.
- C. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.

- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
 2. Maximum Service Temperature: 850 degrees F.
 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
 2. Maximum Service Temperature: 650 degrees F.
 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Blanket: 1.0 pcf density.
 3. Weave: 10 by 20.
- H. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.
 2. Vinyl emulsion type acrylic, compatible with insulation, white color.
- I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- J. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETING AND ACCESSORIES

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive: Compatible with insulation.
- B. Aluminum Jacket:
1. Thickness: 0.025 inch sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2 inch laps.
 4. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- I. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.
- L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

- N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

- A. Plumbing Systems:
1. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: Up to 1-1/2 inch.
 - 2) Thickness: 1-1/2 inch.
 - b. Glass Fiber Insulation:
 - 1) Pipe Size Range: Above 1-1/2 inch.
 - 2) Thickness: 2 inch.
 2. Domestic Hot Water Recirculation:
 - a. Glass Fiber Insulation:
 - 1) Pipe Size Range: All sizes.
 - 2) Thickness: 1 inch.
 3. Domestic Cold Water:
 - a. Glass Fiber Insulation:
 - 1) Thickness: 1 inch.
- B. Cooling Systems:
1. Condensate Drains:
 - a. Glass Fiber Insulation:
 - 1) Thickness: 1/2 inch.
 2. Refrigerant Piping:
 - a. Glass Fiber Insulation:
 - 1) Thickness: 1/2 inch.

END OF SECTION

**SECTION 22 1005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet of building.
- D. Domestic water piping, above grade.
- E. Storm drainage piping, buried within 5 feet of building.
 - 1. Storm drainage piping, above grade.
 - 2. Natural gas piping, buried within 5 feet of building.
 - 3. Natural gas piping, above grade.
 - 4. Pipe flanges, unions, and couplings.
 - 5. Pipe hangers and supports.
 - 6. Ball valves.
 - 7. Butterfly valves.
 - 8. Pressure reducing valves.
 - 9. Pressure relief valves.
 - 10. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 22 0719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- E. ASME B31.1 - Power Piping; 2018.
- F. ASME B31.9 - Building Services Piping; 2017.
- G. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2019.
- H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- I. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.
- J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).
- K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- L. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2020.
- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- N. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

- O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
- P. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.
- Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
- R. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
- S. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
- T. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- U. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015, with Editorial Revision (2018).
- V. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.
- W. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2017.
- X. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012 (Reapproved 2018).
- Y. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- Z. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.
- AA. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.
- BB. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- CC. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2019a.
- DD. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2020.
- EE. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2019a.
- FF. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
- GG. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- HH. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- II. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).
- JJ. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.
- KK. AWWA C606 - Grooved and Shouldered Joints; 2015.
- LL. AWWA C651 - Disinfecting Water Mains; 2014.
- MM. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2017 (Revised 2018).
- NN. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2012 (Revised 2018).

- OO. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- PP. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- QQ. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.
- RR. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.
- SS. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- TT. MSS SP-67 - Butterfly Valves; 2017.
- UU. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- VV. NSF 61 - Drinking Water System Components - Health Effects; 2019.
- WW. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- XX. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2017.
- YY. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.
- D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- E. Project Record Documents: Record actual locations of valves.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: AWS A5.8M/A5.8, BCuP copper and silver braze.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: Ductile or gray iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
 - 1. Fittings: Cast iron.
 - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.08 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, forged steel welding type.
 - 2. Joints: ASME B31.1, welded.

3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.09 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.

2.10 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 1 inch:
 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 1. Dimensions and Testing: In accordance with AWWA C606.
 2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
 3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 4. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.11 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.
 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
- B. Plumbing Piping - Drain, Waste, and Vent:
 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron or Carbon steel, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
 4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron or Carbon steel, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 6 inch and Larger: Adjustable steel yoke, cast iron pipe roll, double hanger.

5. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
 6. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.
 7. Wall Support for Hot Pipe Sizes 6 inch and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 10. Floor Support for Hot Pipe Sizes 6 inch and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
 11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
 2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
 3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
 4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
 5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.

2.12 BALL VALVES

- A. Manufacturers:
1. Nibco, Inc: www.nibco.com/#sle.
 2. Uponor, Inc: www.uponorengineering.com/#sle.
 3. Viega LLC: www.viega.com/#sle.
- B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.13 BUTTERFLY VALVES

- A. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

2.14 PRESSURE REDUCING VALVES

- A. Manufacturers:
1. Watts Regulator Company: www.wattsregulator.com/#sle.
- B. 2 inch and Smaller:
1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- C. 2 inch and Larger:
1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.15 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.16 STRAINERS

- A. Size 2 inch and Smaller:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 1-1/2 inch to 4 inch:
 - 1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 1. See Section 22 0719.
- H. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 08 3100.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
- M. Excavate in accordance with Section 31 2316.
- N. Backfill in accordance with Section 31 2323.
- O. Install bell and spigot pipe with bell end upstream.
- P. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.
- Q. Install water piping to ASME B31.9.

- R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- T. Sleeve pipes passing through partitions, walls, and floors.
- U. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- V. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
 - 8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 9. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 22 0548.
 - 10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe valves for throttling, bypass, or manual flow control services.
- F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.
- G. Provide spring-loaded check valves on discharge of water pumps.
- H. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.

- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.08 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inch to 1-1/4 inch:
 - 1) Maximum Hanger Spacing: 6.5 ft.
 - 2) Hanger Rod Diameter: 3/8 inches.
 - b. Pipe Size: 1-1/2 inch to 2 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
 - c. Pipe Size: 2-1/2 inch to 3 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
 - d. Pipe Size: 4 inch to 6 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.
 - e. Pipe Size: 8 inch to 12 inch:
 - 1) Maximum hanger spacing: 14 ft.
 - 2) Hanger Rod Diameter: 7/8 inch.
 - f. Pipe Size: 14 inch and Over:
 - 1) Maximum Hanger Spacing: 20 ft.
 - 2) Hanger Rod Diameter: 1 inch.
 - 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum Hanger Spacing: 6 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

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**SECTION 22 1006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Backwater valves.
- F. Backflow preventers.
- G. Double check valve assemblies.
- H. Water hammer arrestors.
- I. Sumps.
- J. Mixing valves.
- K. Catch basins and manholes.

1.02 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 3000 - Plumbing Equipment.
- C. Section 22 4000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASME A112.6.3 - Floor and Trench Drains; 2019.
- C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
- D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2017.
- E. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009.
- F. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).
- H. NSF 61 - Drinking Water System Components - Health Effects; 2019.
- I. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- J. PDI-WH 201 - Water Hammer Arresters; 2017.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Operation Data: Indicate frequency of treatment required for interceptors.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

- G. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Loose Keys for Outside Hose Bibbs: One.
 - 2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS - SEE PLUMBING FIXTURE SCHEDULE ON DRAWINGS

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or fast closing valves.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION

**SECTION 22 3000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial gas-fired water heaters.
- B. Commercial electric water heaters.
- C. Diaphragm-type compression tanks.
- D. In-line circulator pumps.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.
- C. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- B. Shop Drawings:
 - 1. Indicate heat exchanger dimensions, size of tapings, and performance data.
 - 2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.
- C. Project Record Documents: Record actual locations of components.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Water Softener Salt: 50 pounds.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Certifications:
 - 1. Water Heaters: NSF approved.
 - 2. Electric Water Heaters: UL listed and labeled to UL 174.
 - 3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

- C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.
- D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

- A. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Commercial Gas-Fired Water Heaters:
 - 1. Type: Automatic, natural gas-fired, vertical storage.
 - 2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
 - 3. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 4. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - 5. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.
- B. Commercial Electric Water Heaters:
 - 1. Type: Factory-assembled and wired, electric, vertical storage.
 - 2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
 - 3. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
 - 4. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
 - 5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

- A. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

- B. Impeller: Bronze.
- C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- D. Seal: Carbon rotating against a stationary ceramic seat.
- E. Drive: Flexible coupling.

2.04 ELECTRICAL WORK

- A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.
- B. Electrical characteristics to be as specified or indicated.
- C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.
- D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

END OF SECTION

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**SECTION 22 4000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Mop sinks.
- F. Electric water coolers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.; 2013.
- C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
- E. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2018.
- F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018.
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.
- H. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2009).
- I. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.
- J. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device; 2013 (Reaffirmed 2018).
- K. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors; 2012.
- L. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2005.
- M. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015.
- N. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).
- O. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- P. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer; 2016.
- Q. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- S. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.
- T. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- U. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- V. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- W. NSF 61 - Drinking Water System Components - Health Effects; 2019.
- X. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.
- E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

- A. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Refer to schedules on the plans for fixture selections
- B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- C. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports/wall carriers and bolts.

- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

END OF SECTION

SECTION 23 0500
BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Mechanical Requirements specifically applicable to other Mechanical Sections, in addition to Division 01 - General Requirements.
- B. If conflicts occur between Basic Mechanical Requirements and Division 01, the provisions of Division 01 shall normally dictate; however, the more stringent of the two shall be followed and the Contractor shall indicate the differences in written form and submit to the Engineer for clarification.

1.02 REGULATORY REQUIREMENTS

- A. Obtain and pay for permits and inspection fees for work included in this phase of the Contract. Comply in every respect with requirements of local inspection departments, National Fire Protection Association, and Local and State Ordinances and Codes. However, this requirement does not relieve the Contractor of the responsibility of complying with these specifications and drawings where specific conditions are of a higher quality and quantity than the requirements for complying with the most stringent of the codes, rules, ordinances or the specifications. Reference to standards is intended to be the latest revision of the standard.
- B. The applicable portions of the following listed codes and standards are hereby made a part of this specification, except where requirements are exceeded in these specifications and drawings.
 - 1. National Fire Protection Association (NFPA).
 - 2. Codes and Ordinances of the Local Authority Having Jurisdiction (AHJ).
 - 3. International Mechanical Code, with City Amendments, if applicable.
 - 4. International Plumbing Code, with City Amendments, if applicable.
 - 5. International Fuel Gas Code, with City Amendments, if applicable.
 - 6. International Building Code, with City Amendments, if applicable.

1.03 APPLICABLE STANDARDS

- A. The following organizations are hereinafter referenced as those whose standards are the basis for the designs, and manufactured items purchased shall conform to these standards where applicable.
 - 1. ANSI - American National Standards Institute.
 - 2. AGA - American Gas Association.
 - 3. ASME - American Society of Mechanical Engineers.
 - 4. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
 - 5. ASTM - American Society for Testing Materials.
 - 6. ARI - Air Conditioning and Refrigeration Institute.
 - 7. ADA - Americans with Disabilities Act.
 - 8. AMCA - Air Moving and Conditioning Association.
 - 9. NEBB - National Environmental Balancing Bureau
 - 10. AABC - Associated Air Balance Council
 - 11. UL - Underwriters' Laboratories, inc.
 - 12. AWWA - American Water Works Association.
- B. The following construction standards are required for the installations of this project:
 - 1. SMACNA - Sheet Metal and Air Contractors National Association.
 - 2. Fire Damper and Heat Stop Guide for Air Handling Systems.
 - 3. HVAC Duct Construction Standards.
 - 4. HVAC Air Duct Leakage Test Manual.
 - 5. High Pressure Duct Construction Standards.

6. Ducted Electric Heat Guide for Air Handling Systems.
7. Flexible Duct Performance & Installation Standards.
8. OSHA - Department of Labor: Occupational Safety and Health Standards, Latest Revisions.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications shall be considered complementary to each other and work referenced in one and not included in the other shall be furnished complete as though included in both. In case of conflicts between the drawings and specifications, the specifications shall take precedence.
- B. If floor plans, detail drawings, schedules, or specifications are not sufficiently detailed or explained, or if there are any discrepancies between architectural floor plans, specifications, schedules, or detail drawings, the Contractor shall notify the Engineer of same in writing, prior to bid opening. The Engineer will then inform the Contractor, in writing, which document takes precedence and/or furnish such information, drawings, etc., as required; after which the Contractor shall comply with same as part of this contract.
- C. If the Contractor deems it necessary to make departures from the drawings, details of such departures and reasons for same shall be submitted for acceptance. No departures shall be made without prior written acceptance by the Engineer.
- D. The Contractor shall be responsible for properly using the information on the Architectural, Structural, Civil, Mechanical and Electrical Drawings. All dimensional information shall be obtained from the appropriate drawings for new construction, and by taking actual measurements at the site for work to existing facilities. In no case shall drawings be scaled for dimensions. Should there be a discrepancy in figures, drawings, and/or specifications, the Engineer shall be notified immediately and shall determine the necessary adjustments.
- E. Contractors shall visit the site, verify all existing items indicated on plans and/or in specifications and familiarize themselves with existing conditions and local requirements. The Contractor shall accept conditions as they exist and each proposal shall reflect all costs occasioned by these conditions. The lack of specific information on drawings shall not relieve the Contractor of this responsibility, nor be reason for any extra charges. The submission of bids shall be considered an acknowledgment on the part of the bidder of his site visitation.
- F. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by CEC Corporation shall belong to CEC Corporation. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been met, including the payment of fees. Each page of the drawings, if prepared in whole or in part by CEC Corporation, and all pages of Mechanical, Plumbing and Fire Protection Sections of the Specifications are covered by copyright and may not be reproduced, published or used in any way without the permission of CEC Corporation.
- G. References made herein to materials, equipment, piping, or methods and procedures such as sterilization or cleaning, shall refer to the new items which are a part of this Contract, and shall not pertain to existing systems or material, etc., which are not being changed or rerouted under this Contract.

1.05 ADEQUACY OF WORK

- A. Drawings are diagrammatic and cannot show every connection in detail or every line of piping in its exact location. Details are subject to the requirements of ordinances and also structural and architectural conditions. Carefully investigate structural and finish conditions affecting the work, and arrange the work accordingly; furnish all such fittings and accessories as may be required to meet the conditions to give satisfactory operation.
- B. By submitting a bid on this work, the Contractor sets forth that his personnel has the necessary technical training and ability and that they will install this work in a satisfactory and workmanlike manner, up to the best standard of the trade, complete and in good working order.

- C. Should any discrepancy or apparent difference occur between Drawings and Specifications, or should an error occur in the work of others affecting the mechanical-electrical work, the Contractor shall notify the Engineer at once. If the Contractor proceeds with the work affected without instructions from the Engineer, he shall make good any resultant damage or defect. All misunderstandings of the Drawings and Specifications shall be clarified by the Engineer.

1.06 WORKMANSHIP AND MATERIALS

- A. Workmanship shall be the best quality and performed by mechanics skilled in their trades. The Contractor shall furnish the services of an experienced superintendent who will be constantly in charge of the erection of the work until completed and accepted. Included in the work shall be proper unloading, installing, connecting, adjusting, starting, and testing of work involved, including equipment and materials furnished by others and the Owner.
- B. Unless otherwise hereinafter specified, all materials and equipment under this Division of the Specifications shall be new, of best grade, and as listed in the printed catalogs of the manufacturer. Each article of its kind shall be the standard product of a single manufacturer.
- C. Whenever the words "or equal", "or equal approved", "equivalent equipment", "acceptable", or other words of similar intent or meaning are used, implying that judgment is to be exercised, it is understood that it refers to the judgment of the Engineer.
- D. The Engineer shall have the right to accept or reject material, equipment and/or workmanship, and determine when the Contractor has complied with the requirements herein specified.
- E. The Contractor shall coordinate with all trades in determining that various phases of work will not interfere with the final efficient operation or use of materials or equipment installed under this Contract. Interference shall be called to the attention of the Engineer before installation is made. The Engineer shall then instruct the Contractor to make such changes and corrections as deemed necessary.

1.07 EQUIPMENT: GENERAL

- A. Manufacturers' published instructions shall be followed in making all installations, erecting, cleaning, and operating of all materials and equipment. Rotating equipment shall be statically and dynamically balanced for minimum vibration and low operating noise level.
- B. Equipment capacities shall not be less than specified or scheduled.
- C. All equipment and major components thereof shall be equipped with a permanently attached nameplate bearing manufacturer's name, address, catalog number and serial number. For equipment installed where exposed to the weather, the nameplate shall be corrosion-resistant metal with information engraved or stamped.
- D. All moving parts, belts, pulleys, and other rotating parts shall be provided with suitable guards or enclosures in accordance with Federal, State, and local regulations.
- E. All equipment to be installed shall be the standard catalog products of the manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall be products which have been in satisfactory use at least three years, unless otherwise accepted by the Engineer.
- F. The installation of any materials and equipment not meeting the specified standards shall be removed and all new materials or equipment meeting the approval of the Engineer shall then be installed at no cost to the Owner.
- G. Design is based on equipment as described in these specifications and equipment schedules. Any change in foundation bases, electrical wiring, conduit, circuit breakers, disconnects, connections, piping, controls, and openings that are required by alternate equipment submitted and accepted shall be the responsibility of the Contractor.
- H. The Contractor shall be responsible for placing equipment or apparatus too large to pass through doors or stair wells, etc. within the building prior to completion of the enclosing structures. Properly protect the equipment from damage from normal construction processes

and/or the elements after installation within the structure.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Materials and equipment shall not be stored at the site until ready for installation or until there is suitable space provided to properly protect equipment from the elements. Equipment shall be delivered and stored in original containers and shall be continuously protected from damage. Any damaged materials or equipment shall be replaced with new equipment or repaired to the satisfaction of the Engineer. Repainting of equipment will be required where damaged in shipment or by improper protection at the site. Rotating equipment stored on the site shall be turned through two full rotations a minimum of once a month.

1.09 SUBSTITUTION OF MATERIALS, FIXTURES & EQUIPMENT

- A. Where equipment is specified by a manufacturer's name and catalog number only, or where a specified manufacturer or manufacturers are named as being acceptable, provided all design and space requirements are met, and subject to acceptance by the Engineer, no substitution or other equipment will be allowed.
- B. Where materials, fixtures, or equipment are specified by manufacturer's name and catalog number, and the words "or equal approved" or similar working is used, such specification shall be deemed to establish style, type, and quality of the equipment required and may include certain desirable technical features. The Contractor may offer, for acceptance, any material, item, or equipment or process which he believes is equal to or better in every respect to that indicated or specified as a substitution, provided it also meets space and capacity requirements.
- C. Any alternate proposal for substitute equipment, or use of equipment not specified by catalog number, shall include all necessary changes and additions to other work occasioned by this substitute equipment. Additionally, each alternate proposal shall stipulate that the substitute product will fit the space allotted to the specified items and will provide equal or greater clearances for services, maintenance and/or removal. The Contractor shall be allowed only one substitution proposal; if the substitute items are not acceptable to the Engineer, the specified items or products shall be installed without change in cost.
- D. Acceptance of a proposed substitution shall not be held to have relieved the Contractor of responsibility for the proper execution of the work, nor from guarantee and maintenance requirements imposed by the Contract Documents. Where no substitutions are proposed or accepted in conformity with the provisions of this article, then no deviation from the material or equipment specified will be allowed.
- E. Unless specifically requested hereinafter, prior approval of substitute items will not be considered by the Engineer during the bidding phase.

1.10 SUBMITTAL DATA AND SHOP DRAWINGS

- A. GENERAL: Three copies each of brochures, shop drawings, and material lists as required by the specifications, shall be prepared and submitted to the Engineer for review within thirty days after award of the Contract. No work indicated on any one shop drawing shall be started until such drawings have been reviewed and accepted by the Engineer.
- B. Space is critical; therefore, equipment of larger sizes than shown, even though of an acceptable manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- C. Where equipment manufacturers named as equivalent or accepted as equal are proposed for use by the Contractor, he shall be responsible to coordinate the change with all trades affected. Contractor shall submit, for acceptance, 1/4 inch scale shop drawings for equipment rooms, plan and section, roof plan, etc.

1.11 PRODUCT DATA

- A. Contractors shall submit complete brochures of all equipment to be installed.

- B. Contractors shall submit a list of all material as specified not covered by brochures or shop drawings.
- C. Submittal brochures shall be indexed by specification section with table of contents, bound in a three ring binder, and identical. Data shall be referenced to section and paragraph numbers of the specifications and to fixture and equipment numbers listed or scheduled, and shall be assembled in numerical order of the specification sections and paragraphs. No consideration will be given to partial submittals. No submittal shall be accepted directly from supply house or manufacturer's representatives nor will substitutions be discussed with anyone other than the successful Contractor after the contract is awarded.
- D. All materials and equipment shall be submitted by manufacturer, trade name, and model number. The submittal shall include data requested in the individual sections. The Contractor shall not assume that applicable catalogs are available to the Architect's or Engineer's office. Maintenance and operating manuals and coded order forms are not suitable submittal material. Each sheet of printed material shall be clearly marked (using arrows, underlining, or circling) to show the particular sizes, types, model numbers, ratings, capacities, and options actually being proposed. Non-applicable material shall be crossed out. All specified features must be specifically noted on the submittal.
- E. Where the item is a substitution, the submittal must be complete with adequate proof of its quality equal to the item specified. Substitutions made because of installation problems, non-availability, later delivery, etc., shall be explained in the transmittal letter accompanying the submittal. Substitute items shall be accepted only under the following conditions: "Should the material or equipment fail or perform unsatisfactorily during the warranty period, this material and/or equipment shall be replaced with material or equipment specified by name in these specifications, at no additional cost to the Owner. Contractor shall PERSONALLY bring a sample of the substitute item to the Engineer office for his inspection at time submittals are made if Engineer requests same."
- F. When items are omitted from the submittal or if submittal is not received by the Engineer within thirty days of Contract date, it shall be construed to mean that only items specified by name and number shall be installed and no substitutions shall be accepted.
- G. In the event that submitted materials, appliances, etc., are not, in the opinion of the Engineer, in conformity with the specifications, the Engineer reserves the right to reject this equipment.
- H. If items other than those specified or approved as submitted are found installed on the project, they shall be removed and the specified items shall be installed at no cost to the Owner.
- I. Submittals shall be reviewed by the Engineer for conformance with design concept only. Review will not include deviations from detail requirements unless these deviations are specifically listed by the Contractor in writing and attached to the data. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements; construction criteria including all means and methods, materials, catalog numbers, and similar data for checking and coordinating with the requirements of the work. Quantities of materials and equipment will not be checked by the Engineer.

1.12 SHOP DRAWINGS

- A. Contract drawings are diagrammatic design drawings and are not intended as installation drawings. Each Contractor shall, within thirty days after award of contract, and prior to beginning any installations, prepare new and original detailed shop drawings for the following:
 - 1. Mechanical Rooms
 - 2. Chiller Installations
 - 3. Ductwork
 - 4. Control Wiring Diagrams
 - 5. Interlock Wiring Diagrams
 - 6. Kitchen Plumbing Rough-Ins,

7. and other critical spaces as directed by the Engineer, showing the exact location and dimensions, spacing and location of each piece of equipment and piping. Reproduction of Engineer's design drawings shall not be considered as shop drawings.
- B. The Contractor shall coordinate to ascertain that there are no conflicts. The Contractor is responsible for rearrangement and revision required to dimensions, connection sizes, special installment requirements, horsepower, voltage, and phase of all equipment.
- C. Each trade, in cooperation with all other trades, shall determine, prior to commencing work, the sequence of the installation of all trades.
- D. In no case will wire to wire or terminal type of wiring diagrams for control system be included or checked as submittal; they shall be included as information only. Temperature control function diagram and written description only shall be accepted by the Engineer.
- E. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements, construction criteria including means and methods, and materials and necessary coordination data for making all installations complete and operating to the full intent of the Contract Drawings and Specifications.
- F. Shop drawings shall be submitted to and approved by the Engineer prior to beginning of any installations. The Engineer will assist in resolving installation problems and conflicts only when furnished with complete shop drawings prepared by the Contractor for all phases of the work and only when the Contractor cannot solve a problem. When installations are made without submitting shop drawings, the Contractor is responsible for immediate correction at his own cost for conflicts and to installations contrary to the intent of design drawings.

1.13 CONSTRUCTION RECORD DRAWINGS

- A. Each Contractor shall purchase or obtain from the Architect/Engineer one complete set of final design documents of the Contract Drawings and shall record on these drawings all locations, dimensions, and depths of all buried and concealed piping and conduits, plugged outlets, and equipment. The master copy shall be maintained at the job site at all times and shall be marked daily as construction progresses. These drawings shall not be used for reference or construction but shall be available for the Engineer's review. No backfilling of trenches will be permitted until Record Drawings are approved as up-to-date.
- B. Depth of sewers and other underground piping prints shall be from a permanent bench mark which shall be shown on drawings.
- C. At completion of the work, the data on these prints shall be given to the Engineer of record and transferred electronically to CAD drawing format. The electronic files shall then be copied to a CD for reproducible prints by the Contractor or building Owner, dated, marked "Record Drawings".

1.14 MANUFACTURER'S INSPECTION

- A. At the completion of work and before acceptance, an authorized representative of the manufacturers of mechanical and electrical equipment shall personally inspect the installation and operation of his equipment to determine that it is properly installed and in good operating order. If equipment is to be concealed, the representative shall make his checks during the course of installation. The Contractor shall submit to the Engineer a statement signed by each manufacturer's accordance with the manufacturer's recommendations and is operating properly.
- B. Inspection shall include new air conditioning equipment, special systems, and such items as are specifically designated by the Engineer.

1.15 TESTING LABORATORY CERTIFICATION

- A. All equipment and materials where applicable shall be listed by Underwriters' Laboratories and shall bear the Underwriters' Laboratories label.
- B. All material, equipment, products furnished and installed on this project shall bear the label, symbol and other identifying mark of a nationally recognized testing laboratory that maintains

periodic inspection of production of labeled and/or listed equipment or material and whose listing of labeling states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner, when such label, symbol, or listing is available.

1.16 FIRE AND SMOKE DEVELOPMENT RATINGS OF MATERIALS

- A. All materials and products installed on this project shall have published fire and smoke developed ratings that conform with U.L. classifications and NFPA 90A and shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less and a fuel contribution rating of 50 or less.

1.17 ASBESTOS

- A. No product which contains asbestos shall be incorporated into any component of this Project.
- B. If asbestos is encountered in any existing installations, Contractor shall stop work immediately and notify the Owner. No work shall be commenced in the area containing asbestos until complete removal or abatement has been accomplished by Owner.

1.18 EXISTING UTILITY PIPING

- A. The drawings indicate all known utility and drainage piping existing on the site of the work. Location of said piping is in accordance with information furnished to the Engineer by the Owner. Responsibility for locating, uncovering, disposing, or maintaining all existing utility piping shall rest solely with the Contractor, who shall plan and conduct his operations in such a manner to insure safe conditions for the entire construction period.
- B. Existing underground piping shall be maintained in service unless otherwise noted. Contractor shall promptly repair all utility piping to be maintained in service, at no expense to the Owner, in the event that they are damaged as a result of his work of this project. All valve boxes, manholes, or other appurtenances of utilities which are to remain in service shall be raised or lowered to meet new finished grades as indicated on appropriate drawings.
- C. Make arrangements for connections to utilities required for the work as shown on drawings and pay all charges and fees in connection with any service connections, making installations complete in all aspects.
- D. Each Contractor shall furnish and install all materials, equipment, and labor required for finished, complete, and operating service connections. Contractors shall be responsible for making personal contact with proper officials of utility companies prior to bid opening and obtaining all details of service requirements and for including ALL costs for ALL requirements for complete services.
- E. Any detail requirements for utility metering and/or connections is specified hereinafter in the appropriate section.
- F. Existing utility piping which is to be abandoned shall be completely removed where it occurs in the area of excavation. Abandoned piping shall be plugged or capped in a manner acceptable to the Engineer. Existing manholes shown to be abandoned shall be filled with sand.
- G. Any minor adjustment in location or alignment of new work to avoid or to connect to existing utilities shall be performed as directed by the Engineer without additional cost to the Owner.

1.19 INTERRUPTION OF SERVICES

- A. While work is in progress, except for designated short intervals when connections are to be made, continuity of service shall be maintained to all existing systems. Time and duration of interruptions shall be coordinated with the Owner. The Contractor shall be responsible for any interruptions to service and shall repair any damages to existing system caused by his operations.
- B. Existing air conditioning, plumbing, and special systems serve vital operations. These vital operations include providing for the general health and welfare of the building. To satisfy these requirements, all interruptions of service must be held to an outage time of four hours, unless

otherwise approved by the Owner.

- C. Coordination of such outages shall result from a written request to the Superintendent of Construction who will indicate the permissible times for outages. Request shall be submitted at least 72 hours prior to outage time requested.

1.20 EXCAVATION AND BACKFILL

- A. Provide all excavation and backfill required for work of this section, in accordance with applicable requirements of Division 31 - Earthwork Section. Coordinate disposition of building materials to avoid interference with all other work.
- B. Provide barricade protection and shoring as required for safety.
- C. Do not backfill until after testing and inspection of installed pipe work.
- D. All plants, turf, and surfacing that occur in the areas of the excavation shall be carefully removed and placed where they will not be damaged. After the excavations are filled, the plants, turf, and surfacing shall be replaced as directed. All sidewalks, driveways, or other cement or asphalt surfaces which are damaged during excavating shall be repaired to match the adjacent work in material and finish and in accordance with requirements established by authorities having jurisdiction over subject walks, lawns, or streets.
- E. Provide clearance (12 inches minimum) under suspended piping and ductwork under the building. The Contractor shall be responsible for necessary excavation to obtain such clearance and if such clearance is not found to exist at the completion of the project, the Contractor shall excavate as required to meet this specification.
- F. Piping trenches not under the building shall be parallel to building lines unless otherwise noted on drawings.
- G. Trenches shall be cut a minimum of six inches (6") below required depth to allow for bedding material. The bottoms of sewer trenches shall be accurately graded to best secure all available fall. Sewer and water pipes shall be laid in separate trenches. All piping shall have a minimum cover of 24 inches unless otherwise noted or accepted. Trenches shall be a minimum of SIX inches (6") wide and not less than FOUR inches (4") wider than outside diameter of a single pipe or conduit being installed. When more than one pipe is installed in a trench, the trench shall be widened appropriately to allow the pipe to be laid side-by-side with a minimum of FOUR inches (4") of sand between each pipe. In no case shall different services be installed one above the other. Piping and/or conduit of various trades shall NOT be installed in same trench unless permission is granted by the Engineer. Where required by depth and/or type of soil, trenches shall be properly and adequately shored to prevent cave-ins and slides.
- H. Properly backfill, flood, and tamp all excavations to the finished grade AFTER the piping has been observed and accepted. The backfill for all pipe may be excavation material, except that at least six inches (6") of clean pit run sand shall be placed over the pipe and six inches (6") of sand below the pipe. A minimum of 12 inches of sand is required for all piping including sewer. Backfill shall be placed in six inch (6") layers, wetted and compacted to the density of adjacent soil. Continue this process until trenches are completely backfilled. Surplus materials shall be hauled from the project. Where trench backfill settles below finished grade during the one year guarantee period, the Contractor shall take necessary steps to correct same as accepted by the Engineer.
- I. Trenches backfilled prior to observation of piping or conduit by the AHJ shall be reopened as directed by the AHJ.

1.21 OPENINGS: CUTTING, REPAIRING

- A. Holes in Concrete: Sleeves shall be furnished, accurately located, and installed in forms before pouring of concrete. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the acceptance of the Structural Engineer prior to cutting or drilling. No cutting or boring of structural members shall be done without WRITTEN permission of the Structural Engineer.

- B. Verify that all chases and openings are properly located.
- C. Damage to existing facilities shall be repaired as required to restore these facilities to their original condition. All openings through floor, ceilings, walls, etc., shall be sealed rat and insect-proof, whether exposed to view or within walls, with a fire resistant sealant.

1.22 CONCRETE WORK

- A. Provide concrete equipment bases for pumps, air handling units, chillers, boilers, etc. Provide anchors, thrust blocks, and all piping supports in trenches.
- B. Furnish all required templates for anchor bolts and dimension drawings for housekeeping pads. All concrete shall be in accordance with that specified under Division 03 - Concrete of the Specifications.

1.23 MANNER OF RUNNING PIPE AND CONDUIT

- A. All pipe and ducts (except gas), shall be concealed in chases, walls, furred spaces, or above the ceilings unless otherwise noted.
- B. In mechanical/electrical rooms, janitor's closets, or other storage spaces, where necessary, piping may be run exposed. Exposed piping shall be run in the neatest, most inconspicuous manner and parallel to building lines. Piping shall be run high as possible when exposed in rooms.
- C. No piping or duct shall be installed in structural concrete slabs, beams, walls, or concrete structure without prior approval unless specifically noted on the drawings.

1.24 EQUIPMENT AND CONNECTIONS

- A. All apparatus, equipment, devices, and appliances which are indicated to have pipe connections shall be so equipped. Each such mechanical connection shall be valved and/or trapped.

1.25 MOTORS AND CONTROLS

- A. Unless noted to the contrary, motors of one horsepower and larger shall be three phase with voltage compatible with the building electrical system. Motor sizes shown on drawings are minimum acceptable sizes.
- B. Motors less than one horsepower shall be 115 volts or 200/230 volts, single phase, with built-in thermal protection and shall be furnished with manual or magnetic starters as required, unless otherwise noted on drawings.
- C. The Contractor shall furnish a suitable motor starter with the necessary number of auxiliary contacts required for the use with the proper type of switch controls in the cover. Motor starters shall be equal to Furnas, Siemens, General Electric, Cutler-Hammer, or Square D, with three leg overload protection; except special requirements for motor starters shall be specified under the particular piece of equipment requiring starter. Mounting of motor starters and wiring shall be installed under Electrical Division.

1.26 ELECTRICAL WIRING OF TEMPERATURE CONTROL EQUIPMENT

- A. The Contractor shall be responsible for complete installation of all the automatic temperature control wiring. All power wiring, interlock wiring as required, starter connections, and disconnect switches shall be installed under Electrical Division. Control wiring shall be a minimum of No. 18 AWG and shall be copper with THW or THWN-THHN insulation. Control wiring shall be installed in EMT conduit when above grade, PVC when below. See applicable section for conduit specifications.
- B. Contractor shall provide necessary wiring diagrams showing power wiring, interlock wiring, and temperature control wiring which shall be used for making the control wiring and interlock wiring installations.
- C. At the completion of all construction work, there shall be a meeting at the job site of all parties involved, who shall inspect, test, and check each control circuit, interlock circuit, and power

circuit for all equipment and shall determine by mutual agreement that all equipment is properly wired for the operations intended. A letter to this effect, signed by all three parties, shall be furnished to the Engineer at the time of final inspection. This letter shall read as follows:

1. "We, the undersigned authorized representatives of the Contractor, hereby certify that we have met together at the site and have by test and check found that entire temperature control system and interlock wiring systems are properly installed and wired and all items are functioning in accordance with design requirements and Contract Drawings and Specifications."

1.27 CLEAN-UP

- A. All unused material and debris resulting from the performance of work shall be removed from the premises as it accumulates.

1.28 HOISTING, SCAFFOLDING, AND TRANSPORTATION

- A. Furnish hoisting facilities to set materials and equipment in place and provide scaffolding, ladders, and facilities for equipment installations and for adjustment and balancing, installation of grilles, and cleaning of fixtures and devices. Provide transportation to deliver materials, equipment, tools and labor to perform the work.

1.29 SLEEVES FOR ALL PIPES AND CONDUITS

- A. For pipes through outside walls above grade, install Schedule 40 galvanized steel pipe sleeves having an inside diameter of 1-1/2 inches greater than the outside diameter of piping being installed. Sleeves shall be flush with each wall surface.
- B. Where pipes pass through floors not on fill, 22 gage galvanized sheet metal sleeves shall be used. In concrete floors they shall extend one inch above the floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least one inch (1") greater than outside diameter of insulation. Sleeves shall be set before concrete is poured.
- C. Sleeves in footings, grade beams, under sidewalks, drives, and elsewhere noted on drawings shall be Schedule 40 PVC plastic pipe with chemical weld joints. Use long sweep ells where pipe turns are made.
- D. Where pipe passes through a concrete wall, beam, or floor below grade or below ground water level, a through-wall or floor seal shall be installed. Sealing fitting shall be installed in concrete forms before concrete is poured. Fitting shall be O.Z. Gedney Type FSK where sealing is required on one side of wall only and Type WSK where sealing on both sides of wall is required. Installation shall be in accordance with manufacturers' instructions.
- E. The annular space around piping and sleeves shall be filled with a fire resistant sealant as specified hereinafter. Both sides of wall, floor, ceiling, or roof shall be sealed to the satisfaction of the Engineer whether exposed to view or within walls. ALL openings around pipe shall be insect, vermin, and rodent proof.

1.30 ROOF PENETRATIONS AND FLASHINGS

- A. Refer to Specification Division 07 - Thermal and Moisture Protection.

1.31 SEALING OF PENETRATIONS (FIRE STOPPING)

- A. Seal all small openings in floors, walls, ceilings, etc. around pipe, etc. with Dow Corning Fire Stop Sealant System, 3M Fire Barrier 2000+ Silicone Sealant Systems, or approved equal, in conformance with U.L. testing procedures.
- B. Seal all openings larger than 1/4" around pipe, duct, etc., through roof, walls and floors above grade with a two-part foam, or one-part sealant material approved by the Engineer, at least 1-1/2" thick, that will form a watertight, vermin-tight barrier that is capable of containing smoke and fire up to 2000 deg. F. for two hours. Fire and smoke barrier will be required in all floors above grade of multi-story buildings and in all walls of fireproof construction. All empty holes and all large openings around pipe, etc., shall also be filled with two-part fire stopping materials. One-part may be used for single penetrations at plumbing fixtures, sleeves, and fire rated expansion joints.

- C. The firestopping system shall be materials that expand to fill cavities or provide adhesion to substrates, and that will maintain seal under normal expected movement of substrates. MATERIAL SHALL NOT REQUIRE A RISE IN TEMPERATURE TO INSTALL OR ACTUATE THE SEAL. Fire Stop Systems shall utilize materials that are UL Classified as "Fill, Void, or Cavity Materials" and "Through Penetration Firestop Systems." Materials shall have been tested in accordance with ASTM E814 "Methods for Fires Tests of Through-Penetration Firestops" and UL 1479 "Fire Tests of Through-Penetration Firestops."
- D. Mineral fiber board, mineral fiber matting and mineral fiber putty may be used as forming and damming for the foam and may be left in place as an integral part of the seal if of a fire rated material. Plywood, particle board, or other combustible foaming and damming materials shall be removed after foaming is completed.
- E. Foam exposed in finished areas shall be neatly trimmed flush with the finish surface. In traffic areas, foam sealed areas shall be covered with a traffic surface approved by the Architect.
- F. Application of foam in penetrations shall be made in accordance with the manufacturer's recommended procedure. Upon completion of the installation, the openings around all penetrations shall be airtight to prevent passage of water, smoke, fire or vermin. Proper installation shall be verified by proper color change and cell structure of cured foam.
- G. Damming materials shall be removed after foam has cured for 24 hours if of other than fire sensitive materials. Seal all voids that have developed in foam with Dow Corning RTV sealant as required to provide full coverage.
- H. Inspect penetration seals after 24 hours and inject additional foam where required for a tight seal. Reinspect after added foam has cured 24 hours. Cut and trim cured foam with sharp knife as required for finished appearance.
- I. Nelson Flameseal Putty, Flamemaster (Flamastic 77), and Thomas & Betts Flamesafe Fire Stop System may be acceptable products for sealing of penetrations provided they are installed according to manufacturer's recommendations and are approved by the Engineer prior to installation.

1.32 FLOOR AND CEILING PLATES

- A. Furnish and install chromium plated escutcheon plates around pipes passing exposed through walls, floors, or ceilings. Plates shall be sized to fit outside of pipe or sleeves and/or insulation and shall fit snugly. Plates shall fit around sleeves where they extend through the floor. Solid chromium plated plates with set screws shall be installed on any piping where split ring or compression type plates will not stay in position.
- B. Where ducts pass through walls, floors, or ceilings, install sheet metal collars to cover the void around the duct where fire barrier is not required.
- C. Escutcheons of galvanized steel shall be installed on all steel or aluminum flue vent pipes.

1.33 TESTS AND ADJUSTMENTS

- A. No piping work, fixtures, or equipment shall be concealed or covered until they have been observed by the Engineer, who shall be notified a minimum of 48 hours in advance. All work shall be completely installed, tested as required by this section and the City and State Ordinances, and shall be repeated upon request to the satisfaction of the Engineer's representative.
- B. All domestic water piping shall be flushed out, tested at 150 psi and shall be left under pressure of the supply main or a minimum of 40 PSI for the balance of the construction period.
- C. Piping tests shall be made with the medium and under pressures listed below:

1.34 TEST

- A.

TYPE OF SYSTEM	GAGE PRESSURE (Lb/sq.in. or vacuum in inches)	TEST MEDIUM
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Soil, Waste, and Vent piping with Bldg. including Rain Water leaders and Storm Drains	Minimum of 10 feet head in excess of ultimate pressure for 4 hrs. min, with no loss in head.	Water
Domestic Hot and Cold Water	150 PSI: 24 hours	Water
	15" HG: 2 hours	Air
Gas: Low Pressure (Less than 12" HG)	125 PSI: 8 hours	Air
Gas: High Pressure	Twice reduced pres. but not less than 50 PSI	Air
Compressed Air	125 PSI: 24 hours	Nitrogen
Vacuum	150 PSI: 24 hours	Air or Water
Oxygen		Air or Water
Steam: To 15 PSI	100 PSI: 24 hours	Air or Water
Steam: 16-100 PSI	150 PSI: 24 hours	Air or Water
Steam: 100-250 PSI	300 PSI: 24 hours	
Steam Condensate	150 PSI: 24 hours	Air or Water
		Air or Water
Chilled and Hot Water	100 PSI: 24 hours	
Condenser Water	100 PSI: 24 hours	

1. NOTE: Additional test may be required as specified as in each Section of these Specifications.

- B. Test gages shall have been calibrated for accuracy within three (3) months of date tests are made. Evidence of calibration shall be available to Engineer upon request.
- C. Test gages shall have a range such that the test pressure will fall at mid-range of dial.
- D. For remodel projects, test medium shall be the same substance as that being used in the system.
- E. Test Procedures shall be applied for minimum periods noted and until tests are complete.
- F. Final pressures at end of test period shall be no more or less than that caused by expansion or contraction of the test medium due to temperature changes.
- G. Check of systems during application of test pressures shall include visual check for water medium leakage, soap bubble, or similar for air and nitrogen medium.
- H. During heating and cooling cycles, linear expansion shall be checked at all elbows, U bends, expansion joints, etc., for proper clearance.
- I. The Engineer shall be notified 48 hours prior to each test and other specification requirements requiring action by the Engineer. All tests shall be made in presence of the City Inspector and Engineer's representative.
- J. Maintain written logs of all tests specified above.

1.35 OPERATION TEST

- A. At completion of installations, Contractor shall operate all mechanical and plumbing systems for a period of at least two days of eight hours each to demonstrate fulfillment of the requirements of the Contract. During this time, all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Engineer.

1.36 FINAL OPERATION AND INSTRUCTION

- A. Upon completion of the installation of the equipment and after final acceptance, and on Engineer's request, the Contractor shall place a competent person at the building who shall operate the plant for a period of one eight hour day, instructing the Owner in all details of operation and maintenance. This requirement is in addition to "Operation Test" specified above.
- B. Any required instructions from manufacturer's representatives shall be given during this period. The time specified under "Operation Test" will not substitute for the one day of final operation and instruction.

1.37 OPERATION

- A. The Owner may require operation of parts of all of the installation for beneficial occupancy prior to final acceptance.
- B. Cost of utilities for such operation shall be paid by the Owner. Said operation shall not be construed as acceptance of the work; however, Contractor shall obtain written agreement with Owner regarding beginning date for warranty and guarantee purposes. Unless such agreement is obtained, warranties and guarantees shall go into effect upon completion.

1.38 DAMAGE BY LEAKS

- A. The Contractor shall be responsible for damages to the grounds, walks, roads, buildings, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping system installed by this Contractor as a part of this Contract. He shall repair, at his expense, all damage so caused. All repair work shall be done as directed by the Engineer.

1.39 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibilities during the Contract period.

1.40 REQUIREMENTS FOR FINAL ACCEPTANCE OF PROJECT

- A. All of the following items must be completed prior to final acceptance of project. No exceptions will be made and no final acceptance of payment will be made until all items are completed.
 - 1. **CLEANING EQUIPMENT AND PREMISES:**
 - a. Thoroughly clean all parts of the piping, valves, and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease; adhesive labels, and foreign materials shall be removed. Surfaces shall be carefully wiped.
 - b. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.
 - c. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves, and similar items shall be thoroughly cleaned.
 - d. Gas, air, and oil piping shall be blown out with clean compressed air or inert gas.
 - e. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of the work.
 - 2. **DEFICIENCY LISTS:** Correct all deficiencies listed at time of Substantial Completion.
 - 3. **OWNER'S OPERATING AND SERVICE MANUAL:** Submit, at least ten days prior to Final Acceptance, one copy of the Owner's Manual to the Engineer for his acceptance. Following the Engineer's acceptance, prepare three copies of bound, indexed, Owner's Manual to be delivered at time of Final Acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System piping and valving diagram.

- c. System control drawings.
- d. System interlock drawings.
- e. System maintenance instructions.
- f. Material and equipment lists.
- g. Serial numbers of all principal pieces of equipment.
- h. Manufacturer's, suppliers', and subcontractors' names, addresses, and telephone numbers; both local representatives and manufacturers' service headquarters.
- i. Equipment operating and maintenance instructions and parts lists.
- j. Certified performance curves.
- k. Manufacturer's certification.
- l. Balancing and performance test report.
- m. Oiling, lubrication, and greasing data.
- n. Complete electrical load data from operation test.
- o. Belt sizes, types and lengths.
- p. Valve chart.
- 4. INSTRUCTIONS:
 - a. All verbal instructions as herein specified shall have been performed.
 - b. Provide the following:
 - 1) System operating instructions.
 - 2) System piping and valving diagram.
 - 3) System control drawings.
 - 4) System interlock drawings.
- 5. CERTIFICATIONS: Provide three bound copies containing the following:
 - a. Balancing and Performance Test Report.
 - b. Manufacturer's certifications.
 - c. Contractor's guarantees.
 - d. Owner's acknowledgment of receipt of instruction, enumerating items in Owner's Manual. List of manufacturers' guarantees executed by the Contractor (those extending beyond one year.)
- 6. RECORD DRAWINGS: Deliver the specified record drawings to the Engineer.
- 7. Furnish the services of an Engineer or Technician acceptable to the Engineer to instruct the Owner's authorized representative in the complete and detailed operation of each and every system and piece of equipment. Instructions shall be conducted for the period of time necessary to thoroughly familiarize Owner's personnel and to accomplish the desired results. Upon completion of these instructions to the Owner, provide a letter to the Owner signed by him stating dates and names of personnel giving instruction and those receiving instruction. NOTE: One copy of these letters shall be included in data to be furnished for final acceptance and shall be sent directly to the Engineer.

1.41 GUARANTEES AND WARRANTIES

- A. The Contractor shall guarantee to the Owner that all labor, materials furnished, and work performed are in accordance with the contract, contract drawings, specifications, authorized alterations, and additions. Should any defect develop during the contract guarantee period due to improper materials, workmanship, or arrangement, the same together with any other work affected in correcting such defect shall be made good by the Contractor without expense to the Owner.
- B. The materials and equipment shall be warranted to be free from defects by the manufacturer. Any defect that develops or failure that occurs during the contract guarantee period together with any other work affected in correcting such defect or failure shall be made good by the Contractor without expense to the Owner. Manufacturer and Contractor shall include cost of labor in the warranty of all equipment.
- C. The contract guarantees and warranty periods shall be from the date the complete facility is accepted by the Owner, unless other dates are mutually agreed upon between Owner and

Contractor.

- D. The Contractor's work shall be guaranteed for a minimum of one year unless noted otherwise in specific sections of these specifications.
- E. The materials and equipment shall be warranted for a minimum of one year. Some components may be specified with or normally have longer standard warranty periods. In this case, the longer warranty period shall be provided by the Contractor.

1.42 DEMOLITION AND RELOCATION (WHERE APPLICABLE)

- A. The Contractor shall remove and/or relocate, modify, or reinstall all items as indicated on drawings or required by the installation of new materials, equipment, and outlets. All removal and/or salvage and all materials and equipment shall remain the property of the Owner and shall be stored at such locations on site as designated by the Owner.
- B. All waste, trash, debris and other such unusable items shall be promptly removed from the site and disposed by the Contractor.
- C. All items of equipment to be relocated shall be thoroughly cleaned, inspected, and reinstalled in a proper manner by workmen skilled in the trade and in conformance with standard practice of trade involved. Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore item to good operation. Should equipment designated for relocation be found to be damaged and/or unsuitable for relocation, it shall be called to the attention of the Engineer prior to dismantling for further instructions before removal. Items damaged during removal and/or storage are the responsibility of the Contractor and shall be replaced or repaired by him in a manner acceptable to the Owner. After reinstallation, items shall be "fire-tested" and/or given operational tests and put back into proper working order. Service piping and/or wiring to items to be removed or relocated shall be removed to points at which reuse is to be continued or service is to remain. Services not reused shall be capped, sealed, or otherwise cut-off or disconnected in a safe manner acceptable to the Owner and shall be done in such a manner to result in a minimum of interruption to services of adjacent occupied areas. Services to existing occupied areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specified acceptance of the Owner and a time schedule accepted by him for the cut-off period.
- D. The Contractor shall be responsible for the loss or damage of existing facilities caused by him or his workmen and shall be responsible for repairing all damage and the replacement of such losses. The Contractor shall erect such temporary barricades, with necessary safety devices as required, to protect working personnel and/or others from injury and shall remove such temporary protection upon completion of the project. Where existing construction is removed to provide working access to existing utilities and where partitions, walls, floors, and ceilings are removed, the Contractor shall remove and reinstall in locations accepted, all devices required for the complete final system in each and every respect. Contractor shall provide temporary service facilities to all equipment which must remain in operation during the construction period and shall make such necessary arrangements, send proper notices, and perform all such services as required to maintain in service operation all plumbing, air conditioning and ventilation systems in all new and existing areas as required for the continuing operation of the facility being remodeled.
- E. The Contractor shall be responsible for proper operation of existing facilities in the existing buildings after water or gas services have been cut off and/or systems have been drained for necessary changes or additions to systems. The Contractor shall check all flush valves and other water consuming devices and shall clean and service any items which are malfunctioning due to dirt or trash entering pipe. Any stuck flush valves shall be serviced. The Contractor shall survey entire area where gas is cut off and shall relight all pilots on all equipment upon restoration of gas and shall restore all gas fired equipment to normal operation.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

PART 4 COORDINATION

4.01 EMBEDS AND BLOCKOUTS

- A. All trade Contractors requiring any embedded items to be cast into the precast concrete wall panels shall review the wall panel shop drawings and indicate the exact location and piece mark of the embedded item on the panel elevations. These items include, but are not limited to: hollow metal door frames, channel frames, steel plates, sleeves, blockouts, conduit, junction boxes, and any other equipment required by other trades. The wall panel shop drawings shall be reviewed and returned to the precast panel manufacturer with cut sheets and any special instructions pertinent to the placement of the embedded items.
- B. All openings and embeds required for proper installation of Contractor's equipment not shown on shop drawings marked up by Contractor shall be provided by responsible Contractor at no additional cost to the project.

4.02 DELIVERY AND INSTALLATION

- A. All trade Contractors shall furnish and deliver any embedded items required for their trade to the precast plant manufacturer. These Contractors shall have a technician present at the precast manufacturing plant to supervise this work at no charge to the precast manufacturer.

4.03 SCHEDULE

- A. The review and return of the embed placement submittal drawings and the delivery of embedded items shall be done in a timely manner that will not delay the production schedule of the precast manufacturer. Any item not delivered in time for casting into the wall panels shall be rectified by the trade requiring that item at their expense. In a case where embedded items are not delivered in time for casting into a wall panel, the precast manufacturer shall provide a blockout based on sizes furnished by the trades requiring them.

END OF SECTION

**SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.

1.02 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
- C. NEMA MG 1 - Motors and Generators; 2018.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 5 horsepower.
- D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- E. Operation Data: Include instructions for safe operating procedures.
- F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for HVAC use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
- B. Comply with NFPA 70.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

- A. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service: Refer to Drawings for required electrical characteristics.
- B. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.

2. Design for continuous operation in 104 degrees F environment.
 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 4. Motors with frame sizes 215T and larger: Energy efficient type.
- C. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.
- D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- E. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 SINGLE PHASE POWER - SPLIT PHASE MOTORS

- A. Starting Torque: Less than 150 percent of full load torque.
- B. Starting Current: Up to seven times full load current.
- C. Breakdown Torque: Approximately 200 percent of full load torque.
- D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
- E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.03 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated ball bearings.
- G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

- D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
- G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
- I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours.
Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- J. Sound Power Levels: To NEMA MG 1.
- K. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- L. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SCHEDULE

- A. NEMA Open Motor Service Factors.
 - 1. 1/6-1/3 hp:
 - a. 3600 rpm: 1.35.
 - b. 1800 rpm: 1.35.
 - c. 1200 rpm: 1.35.
 - d. 900 rpm: 1.35.
 - 2. 1/2 hp:
 - a. 3600 rpm: 1.25.
 - b. 1800 rpm: 1.25.
 - c. 1200 rpm: 1.25.
 - d. 900 rpm: 1.15.
 - 3. 3/4 hp:
 - a. 3600 rpm: 1.25.
 - b. 1800 rpm: 1.25.
 - c. 1200 rpm: 1.15.
 - d. 900 rpm: 1.15.
 - 4. 1 hp:
 - a. 3600 rpm: 1.25.
 - b. 1800 rpm: 1.15.
 - c. 1200 rpm: 1.15.
 - d. 900 rpm: 1.15.
 - 5. 1.5-150 hp:
 - a. 3600 rpm: 1.15.
 - b. 1800 rpm: 1.15.

- c. 1200 rpm: 1.15.
- d. 900 rpm: 1.15.
- B. Three Phase - Energy Efficient, Open Drip-Proof Performance:
 - 1. 1200 rpm.
 - a. 1 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 72.
 - 3) Minimum Percent Efficiency: 81.
 - b. 1-1/2 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 73.
 - 3) Minimum Percent Efficiency: 83.
 - c. 2 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 75.
 - 3) Minimum Percent Efficiency: 85.
 - d. 3 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 60.
 - 3) Minimum Percent Efficiency: 86.
 - e. 5 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 65.
 - 3) Minimum Percent Efficiency: 87.
 - f. 7-1/2 hp:
 - 1) NEMA Frame: 254T.
 - 2) Minimum Percent Power Factor: 73.
 - 3) Minimum Percent Efficiency: 89.
 - g. 10 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 74.
 - 3) Minimum Percent Efficiency: 89.
 - h. 15 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 77.
 - 3) Minimum Percent Efficiency: 90.
 - i. 20 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 78.
 - 3) Minimum Percent Efficiency: 90.
 - j. 25 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 74.
 - 3) Minimum Percent Efficiency: 91.
 - k. 30 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 78.
 - 3) Minimum Percent Efficiency: 91.
 - l. 40 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 77.
 - 3) Minimum Percent Efficiency: 93.

- m. 50 hp:
 - 1) NEMA Frame: 365T.
 - 2) Minimum Percent Power Factor: 79.
 - 3) Minimum Percent Efficiency: 93.
- n. 60 hp:
 - 1) NEMA Frame: 404T.
 - 2) Minimum Percent Power Factor: 82.
 - 3) Minimum Percent Efficiency: 93.
- o. 75 hp:
 - 1) NEMA Frame: 405T.
 - 2) Minimum Percent Power Factor: 80.
 - 3) Minimum Percent Efficiency: 93.
- p. 100 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 80.
 - 3) Minimum Percent Efficiency: 93.
- q. 125 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 84.
 - 3) Minimum Percent Efficiency: 93.
- 2. 1800 rpm.
 - a. 1 hp:
 - 1) NEMA Frame: 143T.
 - 2) Minimum Percent Power Factor: 84.
 - 3) Minimum Percent Efficiency: 82.
 - b. 1-1/2 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 84.
 - c. 2 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 84.
 - d. 3 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 86.
 - e. 5 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 87.
 - f. 7-1/2 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 88.
 - g. 10 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 89.
 - h. 15 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 85.

- 3) Minimum Percent Efficiency: 91.
- i. 20 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 91.
- j. 25 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 91.
- k. 30 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 92.
- l. 40 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 92.
- m. 50 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 93.
- n. 60 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 93.
- o. 75 hp:
 - 1) NEMA Frame: 365T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 93.
- p. 100 hp:
 - 1) NEMA Frame: 404T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 93.
- q. 125 hp:
 - 1) NEMA Frame: 405T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 93.
- r. 150 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 93.
- s. 200 hp:
 - 1) NEMA Frame: 445T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 94.
- 3. 3600 rpm.
 - a. 1-1/2 hp:
 - 1) NEMA Frame: 143T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 82.
 - b. 2 hp:
 - 1) NEMA Frame: 145T.

- 2) Minimum Percent Power Factor: 87.
- 3) Minimum Percent Efficiency: 82.
- c. 3 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 84.
- d. 5 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 85.
- e. 7-1/2 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 86.
- f. 10 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 87.
- g. 15 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 89.
 - 3) Minimum Percent Efficiency: 89.
- h. 20 hp:
 - 1) NEMA Frame: 254T.
 - 2) Minimum Percent Power Factor: 89.
 - 3) Minimum Percent Efficiency: 90.
- i. 25 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 92.
 - 3) Minimum Percent Efficiency: 90.
- j. 30 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 91.
 - 3) Minimum Percent Efficiency: 91.
- k. 40 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 92.
 - 3) Minimum Percent Efficiency: 92.
- l. 50 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 89.
 - 3) Minimum Percent Efficiency: 93.
- m. 60 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 91.
 - 3) Minimum Percent Efficiency: 93.
- n. 75 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 93.
- o. 100 hp:
 - 1) NEMA Frame: 365T.

- 2) Minimum Percent Power Factor: 88.
- 3) Minimum Percent Efficiency: 92.
- C. Three Phase - Energy Efficient, Totally Enclosed, Fan Cooled Performance:
 - 1. 1200 rpm.
 - a. 1 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 72.
 - 3) Minimum Percent Efficiency: 81.
 - b. 1-1/2 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 73.
 - 3) Minimum Percent Efficiency: 83.
 - c. 2 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 68.
 - 3) Minimum Percent Efficiency: 85.
 - d. 3 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 63.
 - 3) Minimum Percent Efficiency: 86.
 - e. 5 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 66.
 - 3) Minimum Percent Efficiency: 86.
 - f. 7-1/2 hp:
 - 1) NEMA Frame: 254T.
 - 2) Minimum Percent Power Factor: 68.
 - 3) Minimum Percent Efficiency: 89.
 - g. 10 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 75.
 - 3) Minimum Percent Efficiency: 89.
 - h. 15 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 72.
 - 3) Minimum Percent Efficiency: 90.
 - i. 20 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 76.
 - 3) Minimum Percent Efficiency: 90.
 - j. 25 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 71.
 - 3) Minimum Percent Efficiency: 90.
 - k. 30 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 79.
 - 3) Minimum Percent Efficiency: 91.
 - l. 40 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 78.
 - 3) Minimum Percent Efficiency: 92.

- m. 50 hp:
 - 1) NEMA Frame: 365T.
 - 2) Minimum Percent Power Factor: 81.
 - 3) Minimum Percent Efficiency: 92.
- n. 60 hp:
 - 1) NEMA Frame: 404T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 92.
- o. 75 hp:
 - 1) NEMA Frame: 405T.
 - 2) Minimum Percent Power Factor: 80.
 - 3) Minimum Percent Efficiency: 92.
- p. 100 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 93.
- q. 125 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 93.
- 2. 1800 rpm.
 - a. 1 hp:
 - 1) NEMA Frame: 143T.
 - 2) Minimum Percent Power Factor: 84.
 - 3) Minimum Percent Efficiency: 82.
 - b. 1-1/2 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 84.
 - c. 2 hp:
 - 1) NEMA Frame: 145T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 84.
 - d. 3 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 87.
 - e. 5 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 88.
 - f. 7-1/2 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 89.
 - g. 10 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 84.
 - 3) Minimum Percent Efficiency: 90.
 - h. 15 hp:
 - 1) NEMA Frame: 254T.
 - 2) Minimum Percent Power Factor: 86.

- 3) Minimum Percent Efficiency: 91.
 - i. 20 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 91.
 - j. 25 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 84.
 - 3) Minimum Percent Efficiency: 92.
 - k. 30 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 93.
 - l. 40 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 83.
 - 3) Minimum Percent Efficiency: 93.
 - m. 50 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 93.
 - n. 60 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 93.
 - o. 75 hp:
 - 1) NEMA Frame: 365T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 93.
 - p. 100 hp:
 - 1) NEMA Frame: 405T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 94.
 - q. 125 hp:
 - 1) NEMA Frame: 444T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 94.
 - r. 150 hp:
 - 1) NEMA Frame: 445T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 94.
 - s. 200 hp:
 - 1) NEMA Frame: 447T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 95.
- 3. 3600 rpm.
 - a. 1-1/2 hp:
 - 1) NEMA Frame: 143T.
 - 2) Minimum Percent Power Factor: 85.
 - 3) Minimum Percent Efficiency: 82.
 - b. 2 hp:
 - 1) NEMA Frame: 145T.

- 2) Minimum Percent Power Factor: 87.
- 3) Minimum Percent Efficiency: 82.
- c. 3 hp:
 - 1) NEMA Frame: 182T.
 - 2) Minimum Percent Power Factor: 87.
 - 3) Minimum Percent Efficiency: 82.
- d. 5 hp:
 - 1) NEMA Frame: 184T.
 - 2) Minimum Percent Power Factor: 88.
 - 3) Minimum Percent Efficiency: 85.
- e. 7-1/2 hp:
 - 1) NEMA Frame: 213T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 86.
- f. 10 hp:
 - 1) NEMA Frame: 215T.
 - 2) Minimum Percent Power Factor: 86.
 - 3) Minimum Percent Efficiency: 87.
- g. 15 hp:
 - 1) NEMA Frame: 254T.
 - 2) Minimum Percent Power Factor: 91.
 - 3) Minimum Percent Efficiency: 88.
- h. 20 hp:
 - 1) NEMA Frame: 256T.
 - 2) Minimum Percent Power Factor: 89.
 - 3) Minimum Percent Efficiency: 89.
- i. 25 hp:
 - 1) NEMA Frame: 284T.
 - 2) Minimum Percent Power Factor: 92.
 - 3) Minimum Percent Efficiency: 90.
- j. 30 hp:
 - 1) NEMA Frame: 286T.
 - 2) Minimum Percent Power Factor: 92.
 - 3) Minimum Percent Efficiency: 91.
- k. 40 hp:
 - 1) NEMA Frame: 324T.
 - 2) Minimum Percent Power Factor: 91.
 - 3) Minimum Percent Efficiency: 91.
- l. 50 hp:
 - 1) NEMA Frame: 326T.
 - 2) Minimum Percent Power Factor: 92.
 - 3) Minimum Percent Efficiency: 90.
- m. 60 hp:
 - 1) NEMA Frame: 364T.
 - 2) Minimum Percent Power Factor: 93.
 - 3) Minimum Percent Efficiency: 91.
- n. 75 hp:
 - 1) NEMA Frame: 365T.
 - 2) Minimum Percent Power Factor: 91.
 - 3) Minimum Percent Efficiency: 91.
- o. 100 hp:
 - 1) NEMA Frame: 405T.

- 2) Minimum Percent Power Factor: 92.
- 3) Minimum Percent Efficiency: 92.

END OF SECTION

**SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2018).
- H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- I. MFMA-4 - Metal Framing Standards Publication; 2004.
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Prefabricated Trapeze-Framed Metal Strut Systems:
 1. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
 2. Strut Channel or Bracket Material:
 3. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.
- C. Hanger Rods:
 1. Threaded zinc-plated steel unless otherwise indicated.
- D. Beam Clamps:
 1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
 2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
 3. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- E. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood: Use wood screws.
 9. Powder-actuated fasteners are not permitted.

10. Hammer-driven anchors and fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
12. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect or Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect or Engineer, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

END OF SECTION

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SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Ductwork: Nameplates.
- G. Heat Transfer Equipment: Nameplates.
- H. Instrumentation: Tags.
- I. Major Control Components: Nameplates.
- J. Piping: Pipe markers.
- K. Relays: Tags.
- L. Small-sized Equipment: Tags.
- M. Thermostats: Nameplates.

2.02 NAMEPLATES

- A. Letter Color: Black.
- B. Letter Height: 1/4 inch.
- C. Background Color: Light Contrasting Color.
- D. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 - 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
 - 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
 - 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
 - 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
 - 6. Ductwork and Equipment: 2-1/2 inch high letters.
- B. Stencil Paint: As specified, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

2.06 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 - 1. HVAC Equipment: Yellow.
 - 2. Fire Dampers and Smoke Dampers: Red.
 - 3. Heating/Cooling Valves: Blue.
 - 4. Plumbing valves: Green

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 9 for stencil painting.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Division 9.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.

- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
- C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Submit name of adjusting and balancing agency for approval within 60 days after award of Contract.
- C. Field Reports: Submit under provisions of Division 1.
- D. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- F. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- G. Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- H. Include detailed procedures, agenda, sample report forms prior to commencing system balance.
- I. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111, NEBB forms, or forms containing information indicated in Schedules.
- J. **PROJECT RECORD DOCUMENTS**
 - 1. Submit under provisions of Division 1.
 - 2. Record actual locations of flow measuring stations balancing valves and rough setting.
- K. **QUALITY ASSURANCE**
 - 1. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance; ASHRAE 111; or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- L. **QUALIFICATIONS**
 - 1. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience.
 - 2. Perform Work under supervision of AABC Certified Test and Balance Technician or NEBB Certified Testing, Balancing and Adjusting Supervisor.

- M. SEQUENCING
 - 1. Sequence work under the provisions of Division 1.
 - 2. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- N. SCHEDULING
 - 1. Schedule work under the provisions of Division 1.
 - 2. Schedule and provide assistance in final adjustment and test of life safety and smoke evacuation system with Fire Authority.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect or Engineer/Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- N. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

- A. Test, adjust, and balance the following:
 - 1. Sprinkler Air Compressor.
 - 2. Electric Water Coolers.
 - 3. Plumbing Pumps.
 - 4. HVAC Pumps.
 - 5. Forced Air Furnaces.
 - 6. Direct Fired Furnaces.
 - 7. Reciprocating Water Chillers.
 - 8. Air Cooled Refrigerant Condensers.
 - 9. Packaged Terminal Air Conditioning Units.
 - 10. Unit Air Conditioners.
 - 11. Air Coils.
 - 12. Terminal Heat Transfer Units.
 - 13. Air Handling Units.
 - 14. Fans.
 - 15. Air Filters.
 - 16. Air Terminal Units.
 - 17. Air Inlets and Outlets.
 - 18. Controls Compressor.

3.09 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.

- 8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
 - 1. Identification/location.
 - 2. Required driven RPM.
 - 3. Driven sheave, diameter and RPM.
 - 4. Belt, size and quantity.
 - 5. Motor sheave diameter and RPM.
 - 6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
 - 1. Identification/number.
 - 2. Manufacturer.
 - 3. Size/model.
 - 4. Impeller.
 - 5. Service.
 - 6. Design flow rate, pressure drop, BHP.
 - 7. Actual flow rate, pressure drop, BHP.
 - 8. Discharge pressure.
 - 9. Suction pressure.
 - 10. Total operating head pressure.
 - 11. Shut off, discharge and suction pressures.
 - 12. Shut off, total head pressure.
- D. Cooling Coils:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Air flow, design and actual.
 - 6. Entering air DB temperature, design and actual.
 - 7. Entering air WB temperature, design and actual.
 - 8. Leaving air DB temperature, design and actual.
 - 9. Leaving air WB temperature, design and actual.
 - 10. Water flow, design and actual.
 - 11. Water pressure drop, design and actual.
 - 12. Entering water temperature, design and actual.
 - 13. Leaving water temperature, design and actual.
 - 14. Saturated suction temperature, design and actual.
 - 15. Air pressure drop, design and actual.
- E. Heating Coils:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Air flow, design and actual.
 - 6. Water flow, design and actual.
 - 7. Water pressure drop, design and actual.
 - 8. Entering water temperature, design and actual.
 - 9. Leaving water temperature, design and actual.
 - 10. Entering air temperature, design and actual.
 - 11. Leaving air temperature, design and actual.
 - 12. Air pressure drop, design and actual.
- F. Electric Duct Heaters:

1. Manufacturer.
 2. Identification/number.
 3. Location.
 4. Model number.
 5. Design kW.
 6. Number of stages.
 7. Phase, voltage, amperage.
 8. Test voltage (each phase).
 9. Test amperage (each phase).
 10. Air flow, specified and actual.
 11. Temperature rise, specified and actual.
- G. Induction Units:
- H. Air Moving Equipment:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Arrangement/Class/Discharge.
 6. Air flow, specified and actual.
 7. Return air flow, specified and actual.
 8. Outside air flow, specified and actual.
 9. Total static pressure (total external), specified and actual.
 10. Inlet pressure.
 11. Discharge pressure.
 12. Sheave Make/Size/Bore.
 13. Number of Belts/Make/Size.
 14. Fan RPM.
- I. Return Air/Outside Air:
1. Identification/location.
 2. Design air flow.
 3. Actual air flow.
 4. Design return air flow.
 5. Actual return air flow.
 6. Design outside air flow.
 7. Actual outside air flow.
 8. Return air temperature.
 9. Outside air temperature.
 10. Required mixed air temperature.
 11. Actual mixed air temperature.
 12. Design outside/return air ratio.
 13. Actual outside/return air ratio.
- J. Exhaust Fans:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.

10. Number of Belts/Make/Size.
11. Fan RPM.
- K. Duct Traverses:
 1. System zone/branch.
 2. Duct size.
 3. Area.
 4. Design velocity.
 5. Design air flow.
 6. Test velocity.
 7. Test air flow.
 8. Duct static pressure.
 9. Air temperature.
 10. Air correction factor.
- L. Duct Leak Tests:
 1. Description of ductwork under test.
 2. Duct design operating pressure.
 3. Duct design test static pressure.
 4. Duct capacity, air flow.
 5. Maximum allowable leakage duct capacity times leak factor.
 6. Test apparatus:
 - a. Blower.
 - b. Orifice, tube size.
 - c. Orifice size.
 - d. Calibrated.
 7. Test static pressure.
 8. Test orifice differential pressure.
 9. Leakage.
- M. Terminal Unit Data:
 1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.
- N. Air Distribution Tests:
 1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.

END OF SECTION

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**SECTION 23 0713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
- F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 250 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.
- E. Outdoor Vapor Barrier Mastic:
 - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, white color.
- F. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 250 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent.
 - 4. Maximum Density: 3 lb/cu ft.
- B. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.04 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with two coats of vapor barrier mastic and glass tape.
- C. Vapor Barrier Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.
- D. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 JACKETING AND ACCESSORIES

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
 - 1. Lagging Adhesive:
 - a. Compatible with insulation.

- B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 36 lb/square.
- C. Aluminum Jacket:
 - 1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
 - 2. Thickness: 0.025 inch sheet.
 - 3. Finish: Smooth.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.05 DUCT LINER

- A. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
 - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
 - 2. Service Temperature: Up to 250 degrees F.
 - 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
 - 4. Minimum Noise Reduction Coefficients:
 - a. 1-1/2 inches Thickness: 0.60.
 - b. 2 inch Thickness: 0.70.
- B. Adhesive: Waterproof, fire-retardant type, ASTM C916.
- C. Liner Fasteners: Galvanized steel, welded with press-on head.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 - 1. Provide insulation with vapor barrier jackets.
 - 2. Finish with tape and vapor barrier jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
 - 1. Provide with or without standard vapor barrier jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- G. External Duct Insulation Application:
 - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 - 2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- H. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

- A. Combustion Air Duct:
1. Flexible Glass Fiber Duct Insulation: 2" inches thick.
 2. Rigid Glass Fiber Duct Insulation: 2" inches thick.
- B. Exhaust Ducts Exposed to Outdoor Air: 2" Duct Wrap with Vapor Barrier
- C. Outside Air Intake Ducts: 2" Duct Wrap with Vapor Barrier
- D. Supply Ducts:
1. Rectangular ductwork: 1-1/2" duct liner
 2. Round ductwork (concealed): 1-1/2" fiberglass duct wrap
 3. Round ductwork (visible): double wall ductwork with 1" liner and perforated inner surface
- E. Return Ducts: 1-1/2" duct liner
- F. Ducts Exposed to Outdoors: 2" Duct Wrap with Vapor Barrier

END OF SECTION

SECTION 23 1123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

- A. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.
- B. Section 33 5216 - Gas Hydrocarbon Piping.
- C. Requirements per piping identification sections.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.
- B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2011 (Addendum A, 2012).
- C. ANSI Z223.1 - National Fuel Gas Code; 2016.
- D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- F. ASME B31.1 - Power Piping; 2018.
- G. ASME B31.9 - Building Services Piping; 2017.
- H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).
- I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- J. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- L. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
- M. AWWA C606 - Grooved and Shouldered Joints; 2015.
- N. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.
- O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- B. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.06 DELIVERY, STORAGE, AND HANDLING

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ANSI Z223.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.02 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

2.03 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 - 1. Dimensions and Testing: In accordance with AWWA C606.
 - 2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
 - 3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 - 4. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
 - 5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High density polypropylene.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

- d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
- e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

2.05 BALL VALVES

- A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, or grooved ends with union.

2.06 PLUG VALVES

- A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.07 STRAINERS

- A. Size 2 inch and Under:
 - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 1-1/2 inch to 4 inch:
 - 1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.
- C. Size 5 inch and Larger:
 - 1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.08 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

- A. Compliance Requirements:
 - 1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
 - 2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
- B. Materials in Contact With Gas:
 - 1. Housing: Aluminum, steel (free of non-ferrous metals).
 - 2. Seals and Diaphragms: NBR-based rubber.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Section ____.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Provide support for utility meters in accordance with requirements of utility companies.
- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- N. Excavate in accordance with Division 31.
- O. Backfill in accordance with Division 31.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- R. Sleeve pipes passing through partitions, walls and floors.
- S. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- T. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 10. Provide hangers adjacent to motor driven equipment with vibration isolation.

3.04 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

- D. Install ball valves for throttling, bypass, or manual flow control services.
- E. Provide plug valves in natural gas systems for shut-off service.

3.05 SERVICE CONNECTIONS

- A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 5216. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.06 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inches to 1-1/4 inches:
 - 1) Maximum Hanger Spacing: 6.5 ft.
 - 2) Hanger Rod Diameter: 3/8 inches.
 - b. Pipe Size: 1-1/2 inches to 2 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
 - c. Pipe Size: 2-1/2 inches to 3 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
 - d. Pipe Size: 4 inches to 6 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.
 - e. Pipe Size: 8 inches to 12 inches:
 - 1) Maximum Hanger Spacing: 14 ft.
 - 2) Hanger Rod Diameter: 7/8 inch.
 - f. Pipe Size: 14 inches and Over:
 - 1) Maximum Hanger Spacing: 20 ft.
 - 2) Hanger Rod Diameter: 1 inch.

END OF SECTION

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**SECTION 23 3100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ducts.
- B. Flexible ducts.
- C. Nonmetal ducts.
- D. Air plenums and casings.
- E. Ducts for kitchen exhaust applications.

1.02 RELATED REQUIREMENTS

- A. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.
- B. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- C. Section 23 3300 - Air Duct Accessories.
- D. Section 23 3319 - Duct Silencers.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2019.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- I. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.
- J. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.
- K. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.
- L. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide data for duct materials, duct liner, and duct connections.
- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for 4 in (1000 kPa) pressure class and higher systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

- E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.
- C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.
- D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
- E. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
 - a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
 - b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.
 - c. Return and Relief Air: 1/2 in-wc pressure class, galvanized steel.
 - d. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
 - e. Heating or Combustion Air: 1/2 in-wc pressure class, galvanized steel.
 - f. Transfer-air and Sound Booths: 1/2 in-wc pressure class, fibrous glass.
 - 2. Low Pressure Service: Up to 2 in-wc:
 - a. Seal: Class C, apply to seal off transverse joints.
 - b. Leakage:
 - 3. Medium and High Pressure Service: Above 3 in-wc:
 - a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
 - b. Leakage:
- F. Duct Fabrication Requirements:
 - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
 - 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
 - 3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
 - 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
 - 5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

- A. Material Requirements:
 1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2.03 AIR PLENUMS AND CASINGS

- A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.
- B. Minimum Fabrication Requirements:
 1. Fabricate acoustic plenum or casing with reinforcing turned inward.
 2. Provide 16 gauge, 0.059-inch sheet steel back facing and 22 gauge, 0.029-inch perforated sheet steel front facing with 3/32-inch diameter holes on 5/32-inch centers.
 3. Construct 3-inch panels packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16 gauge, 0.059-inch sheet steel.
 4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.
- C. Access Doors:
 1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
 2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
 3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

2.04 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

- A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.
- B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.
- C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.
- D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.
- E. Kitchen Hood and Grease Exhaust Duct:
 1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

- D. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.
- E. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.
- H. Use double nuts and lock washers on threaded rod supports.
- I. Connect terminal units to supply ducts directly or with 1-foot maximum length of flexible duct. Do not use a flexible duct to change direction.
- J. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- K. Set plenum doors at 6 to 12 inches above the floor. Arrange door swings so that fan static-pressure holds the door in a closed position.

3.02 CLEANING

- A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.
- B. Clean thoroughly each duct system as indicated within Section 23 0130.51.
- C. Clean the duct system and force air at high velocity through the duct to remove accumulated dust. Clean half the system at a time to obtain sufficient air. Protect equipment that could be harmed by excessive dirt with temporary filters or bypass during cleaning.

END OF SECTION

**SECTION 23 3300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Combination fire and smoke dampers.
- E. Duct access doors.
- F. Duct test holes.
- G. Fire dampers.
- H. Flexible duct connectors.
- I. Smoke dampers.
- J. Volume control dampers.

1.02 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- B. NFPA 92 - Standard for Smoke Control Systems; 2018.
- C. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- F. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- G. UL 555C - Standard for Safety Ceiling Dampers; 2014 (Revised 2017).
- H. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.
- D. Project Record Drawings: Record actual locations of access doors and test holes.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fusible Links: Two of each type and size.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with removable key operator.

2.02 BACKDRAFT DAMPERS - METAL

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

- A. Fabric Backdraft Dampers: Factory-fabricated.
 - 1. Blades: Neoprene coated fabric material.
 - 2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
 - 3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- B. Provide factory sleeve and collar for each damper.
- C. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.
- E. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
- F. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- G. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.
- H. Access Doors: Provide duct access doors for maintenance. Coordinate to provide access doors in ceilings. See Architectural drawings and specifications for type. Access doors in fire rated ceilings must be fire rated.

2.05 DUCT ACCESS DOORS

- A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- B. Access doors with sheet metal screw fasteners are not acceptable.

2.06 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- B. Ceiling (Radiation) Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame and 16 gauge, 0.0598 inch flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
 - 1. Rated for three hour service in compliance with UL 555C.
- C. Horizontal Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- E. Multiple Blade Dampers: 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.
- G. Access Doors: Provide duct access doors for maintenance. Coordinate to provide access doors in ceilings. See Architectural drawings and specifications for type. Access doors in fire rated ceilings must be fire rated.

2.08 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
 - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

2.09 SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.
- B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.
- C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.
- D. Access Doors: Provide duct access doors for maintenance. Coordinate to provide access doors in ceilings. See Architectural drawings and specifications for type. Access doors in fire rated ceilings must be fire rated.

2.10 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Splitter Dampers:
 - 1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
 - 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- C. Single Blade Dampers:
 1. Fabricate for duct sizes up to 6 by 30 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- F. Quadrants:
 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on high velocity systems where indicated. See Section 23 3600 - Air Terminal Units.
- K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

**SECTION 23 3600
AIR TERMINAL UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct bypass air units.

1.02 REFERENCE STANDARDS

- A. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2013).
- B. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
- C. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.03 SUBMITTALS

- A. Division 1 - Submittals: Procedures for submittals.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
- E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Motors: Two of each type and size.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 WARRANTY

- A. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier.
- B. Titus.
- C. MetalAire.

2.02 MANUFACTURED UNITS

- A. Ceiling mounted variable air volume fan powered supply air control terminals for connection to single duct, central air systems, with electric variable volume controls, constant volume control hot water heating coils.

- B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.03 FAN POWERED VARIABLE VOLUME UNITS

- A. Basic Assembly:
1. Casings: Minimum 22 gage galvanized steel.
 2. Lining: Minimum 3/4 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft (24 g/L) density, meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.
 3. Plenum Air Inlets: S slip and drive connections for duct attachment.
 4. Plenum Air Outlets: S slip and drive connections.
- B. Basic Unit:
1. Configuration: Air volume damper assembly and fan in parallel arrangement inside unit casing. Locate control components inside protective metal shroud.
 2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at one inches rated inlet static pressure.
 3. Mount damper operator to position damper normally open or normally closed as required.
- C. Automatic Damper Operator:
1. Electric Actuator: 24 volt with remote temperature read and reset capability.
- D. Fan Assembly
1. Fan: Forward curved centrifugal type with direct drive permanent split capacitor type, thermally protected motor. Refer to Section 15170.
 2. Speed Control: Infinitely adjustable with electric/pneumatic and electronic controls.
 3. Isolation: Fan/motor assembly on rubber isolators.
- E. Hot Water Heating Coil:
1. Construction: 1/2 inch (13 mm) copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig (10380 kPa) pressure, factory installed.
- F. Wiring
1. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
 2. Factory mount transformer for control voltage on electric and electronic control units. Provide terminal strip in control box for field wiring of thermostat and power source.
 3. Wiring Terminations: Wire fan and controls to terminal strip. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
 4. Disconnect Switch: Factory mount unfused disconnect switch.
- G. Controls:
1. Electric or Electronic Controls: Contain in NEMA-1 enclosure with access panel sealed from air flow and mounted on side of unit. Factory mount controls and thermostat to accomplish the following specified sequence of operation.
 2. Electronic Control, Central System Fan "On" - Occupied Mode:
 - a. When duct pressure is sensed indicating primary air system operating, thermostat and primary variable volume damper proportions air flow from central system.
 - b. As thermostat senses reduced cooling demand, volume damper closes. At field adjustable point, unit fan is energized. As cooling demand continues to fall, volume damper closes and fan speed increases.
 - c. If central duct system pressure varies, volume damper maintains constant primary air flow.

- d. As thermostat senses no cooling requirement, control system closes volume damper to minimum 30 percent primary airflow. Before heating is initiated, control enters field adjustable no load band. On sensing need for heat, heating coil is energized proportionally.
- 3. Electronic Control, Central System Fan "Off" - Unoccupied Mode:
 - a. Provide field adjustable temperature setback. On need for heat, terminal unit fan and heating coil are energized.
 - b. Hold volume damper closed.
- H. Thermostat: Electronic type with appropriate mounting hardware.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.
- B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. Provide ceiling access doors or locate units above easily removable ceiling components.
- D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
- E. Do not support from ductwork.
- F. Connect to ductwork in accordance with Section 23 3100.
- G. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.
- H. Verify that electric power is available and of the correct characteristics.

3.03 CLEANING

- A. Vacuum clean coils and inside of units.
- B. Install new filters.

END OF SECTION

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**SECTION 23 3700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Registers/grilles:

1.02 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.03 SUBMITTALS

- A.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 CEILING, SIDEWALL DIFFUSERS, GRILLES, AND REGISTERS

- A. Type: See schedule on drawings.
- B. Frame: As applicable for the ceiling construction.
- C. Fabrication: Steel with baked enamel off-white finish.
- D. Accessories: Damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 9123.

END OF SECTION

**SECTION 26 0500
BASIC ELECTRICAL REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to other Electrical Sections, in addition to Division 01 - General Requirements.
- B. If conflicts occur between Basic Electrical Requirements and Division 01, the provisions of Division 01 shall normally dictate; however, the more stringent of the two shall be followed and the Contractor shall indicate the differences in written form and submit to the Engineer for clarification.

1.02 REGULATORY REQUIREMENTS

- A. Obtain and pay for permits and inspection fees for work included in this phase of the Contract. Comply in every respect with requirements of local inspection departments, National Fire Protection Association, and Local and State Ordinances and Codes. However, this requirement does not relieve the Contractor of the responsibility of complying with these specifications and drawings where specific conditions are of a higher quality and quantity than the requirements for complying with the most stringent of the codes, rules, ordinances or the specifications. Reference to standards is intended to be the latest revision of the standard.
- B. The applicable portions of the following listed codes and standards are hereby made a part of this specification, except where requirements are exceeded in these specifications and drawings.
 - 1. National Fire Protection Association (NFPA).
 - 2. Codes and Ordinances of the Local Authority Having Jurisdiction (AHJ).
 - 3. International Building Code, with City Amendments, if applicable.
 - 4. National Electrical Code, (NFPA-70), with City Amendments, if applicable.
 - 5. National Electrical Safety Code (NESC).

1.03 APPLICABLE STANDARDS

- A. The following organizations are hereinafter referenced as those whose standards are the basis for the designs, and manufactured items purchased shall conform to these standards where applicable.
 - 1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).
 - 2. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS, INC. (ASHRAE).
 - 3. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM).
 - 4. ELECTRICAL TESTING LABORATORIES, INC. (ETL).
 - 5. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA).
 - 6. AMERICANS WITH DISABILITIES ACT (ADA).
 - 7. CERTIFIED BALLAST MANUFACTURERS (CBM).
 - 8. UNDERWRITERS' LABORATORIES, INC. (UL).
 - 9. ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA).
- B. The following construction standards are required for the installations of this project:
 - 1. DEPARTMENT OF LABOR: OCCUPATIONAL SAFETY AND HEALTH STANDARDS (OSHA), LATEST REVISIONS.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications shall be considered complementary to each other and work referenced in one and not included in the other shall be furnished complete as though included in both. In case of conflicts between the drawings and specifications, the specifications shall take precedence.

- B. If floor plans, detail drawings, schedules, or specifications are not sufficiently detailed or explained, or if there are any discrepancies between architectural floor plans, specifications, schedules, or detail drawings, the Contractor shall notify the Engineer of same in writing, prior to bid opening. The Engineer will then inform the Contractor, in writing, which document takes precedence and/or furnish such information, drawings, etc., as required; after which the Contractor shall comply with same as part of this contract.
- C. If the Contractor deems it necessary to make departures from the drawings, details of such departures and reasons for same shall be submitted for acceptance. No departures shall be made without prior written acceptance by the Engineer.
- D. The Contractor shall be responsible for properly using the information on the Architectural, Structural, Civil, Mechanical and Electrical Drawings. All dimensional information shall be obtained from the appropriate drawings for new construction, and by taking actual measurements at the site for work to existing facilities. In no case shall drawings be scaled for dimensions. Should there be a discrepancy in figures, drawings, and/or specifications, the Engineer shall be notified immediately and shall determine the necessary adjustments.
- E. Contractors shall visit the site, verify all existing items indicated on plans and/or in specifications and familiarize themselves with existing conditions and local requirements. The Contractor shall accept conditions as they exist and each proposal shall reflect all costs occasioned by these conditions. The lack of specific information on drawings shall not relieve the Contractor of this responsibility, nor be reason for any extra charges. The submission of bids shall be considered an acknowledgment on the part of the bidder of his site visitation.
- F. Unless otherwise expressly agreed to in writing, all rights to the specifications and drawings prepared by CEC Corporation shall belong to CEC Corporation. The sole exception is that the specifications and drawings may be used for construction of the project for which the specifications and drawings were prepared if all other contractual obligations have been met, including the payment of fees. Each page of the drawings, if prepared in whole or in part by CEC Corporation, and all pages of Electrical Sections of the Specifications are covered by copyright and may not be reproduced, published or used in any way without the permission of CEC Corporation.
- G. References made herein to materials, equipment, devices, or methods and procedures such as cleaning or testing, shall refer to the new items which are a part of this Contract, and shall not pertain to existing systems or material, etc., which are not being changed or rerouted under this Contract.

1.05 ADEQUACY OF WORK

- A. Drawings are diagrammatic and cannot show every connection in detail or every line of conduit in its exact location. Details are subject to the requirements of ordinances and also structural and architectural conditions. Carefully investigate structural and finish conditions affecting the work, and arrange the work accordingly; furnish all such fittings and accessories as may be required to meet the conditions to give satisfactory operation.
- B. By submitting a bid on this work, the Contractor sets forth that his personnel has the necessary technical training and ability and that they will install this work in a satisfactory and workmanlike manner, up to the best standard of the trade, complete and in good working order.
- C. Should any discrepancy or apparent difference occur between Drawings and Specifications, or should an error occur in the work of others affecting the electrical work, the Contractor shall notify the Engineer at once. If the Contractor proceeds with the work affected without instructions from the Engineer, he shall make good any resultant damage or defect. All misunderstandings of the Drawings and Specifications shall be clarified by the Engineer.

1.06 WORKMANSHIP AND MATERIALS

- A. Workmanship shall be the best quality and performed by mechanics skilled in their trades. The Contractor shall furnish the services of an experienced superintendent who will be constantly in charge of the erection of the work until completed and accepted. Included in the work shall be

proper unloading, installing, connecting, adjusting, starting, and testing of work involved, including equipment and materials furnished by others and the Owner.

- B. Unless otherwise hereinafter specified, all materials and equipment under the Electrical Sections of the Specifications shall be new, of best grade, and as listed in the printed catalogs of the manufacturer. Each article of its kind shall be the standard product of a single manufacturer.
- C. The Engineer shall have the right to accept or reject material, equipment and/or workmanship, and determine when the Contractor has complied with the requirements herein specified.
- D. The Contractor shall coordinate with all trades in determining that various phases of work will not interfere with the final efficient operation or use of materials or equipment installed under this Contract. Interference shall be called to the attention of the Engineer before installation is made. The Engineer shall then instruct the Contractor to make such changes and corrections as deemed necessary.

1.07 EQUIPMENT: GENERAL

- A. Manufacturers' published instructions shall be followed in making all installations, erecting, cleaning, and operating of all materials and equipment. Rotating equipment shall be statically and dynamically balanced for minimum vibration and low operating noise level.
- B. Equipment capacities shall not be less than specified or scheduled.
- C. All equipment and major components thereof shall be equipped with a permanently attached nameplate bearing manufacturer's name, address, catalog number and serial number. For equipment installed where exposed to the weather, the nameplate shall be corrosion-resistant metal with information engraved or stamped.
- D. All moving parts, belts, pulleys, and other rotating parts shall be provided with suitable guards or enclosures in accordance with Federal, State, and local regulations.
- E. All equipment to be installed shall be the standard catalog products of the manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall be products which have been in satisfactory use at least three years, unless otherwise accepted by the Engineer.
- F. The installation of any materials and equipment not meeting the specified standards shall be removed and all new materials or equipment meeting the approval of the Engineer shall then be installed at no cost to the Owner.
- G. Design is based on equipment as described in these specifications and equipment schedules. Any change in foundation bases, electrical wiring, conduit, circuit breakers, disconnects, connections, piping, controls, and openings that are required by alternate equipment submitted and accepted shall be the responsibility of the Contractor.
- H. The Contractor shall be responsible for placing equipment or apparatus too large to pass through doors or stair wells, etc. within the building prior to completion of the enclosing structures. Properly protect the equipment from damage from normal construction processes and/or the elements after installation within the structure.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Materials and equipment shall not be stored at the site until ready for installation or until there is suitable space provided to properly protect equipment from the elements. Equipment shall be delivered and stored in original containers and shall be continuously protected from damage. Any damaged materials or equipment shall be replaced with new equipment or repaired to the satisfaction of the Engineer. Repainting of equipment will be required where damaged in shipment or by improper protection at the site. Rotating equipment stored on the site shall be turned through two full rotations a minimum of once a month.

1.09 SUBSTITUTION OF MATERIALS, FIXTURES & EQUIPMENT

- A. Where equipment is specified by a manufacturer's name and catalog number only, or where a specified manufacturer or manufacturers are named as being acceptable, provided all design and space requirements are met, and subject to acceptance by the Engineer, no substitution or other equipment will be allowed.
- B. Where materials, fixtures, or equipment are specified by manufacturer's name and catalog number, and the words "or equal approved" or similar wording is used, such specification shall be deemed to establish style, type, and quality of the equipment required and may include certain desirable technical features. The Contractor may offer, for acceptance, any material, item, or equipment or process which he believes is equal to or better in every respect to that indicated or specified as a substitution, provided it also meets space and capacity requirements.
- C. Any alternate proposal for substitute equipment, or use of equipment not specified by catalog number, shall include all necessary changes and additions to other work occasioned by this substitute equipment. Additionally, each alternate proposal shall stipulate that the substitute product will fit the space allotted to the specified items and will provide equal or greater clearances for services, maintenance and/or removal. The Contractor shall be allowed only one substitution proposal; if the substitute items are not acceptable to the Engineer, the specified items or products shall be installed without change in cost.
- D. Acceptance of a proposed substitution shall not be held to have relieved the Contractor of responsibility for the proper execution of the work, nor from guarantee and maintenance requirements imposed by the Contract Documents. Where no substitutions are proposed or accepted in conformity with the provisions of this article, then no deviation from the material or equipment specified will be allowed.
- E. Unless specifically requested hereinafter, prior approval of substitute items will not be considered by the Engineer during the bidding phase.

1.10 SUBMITTAL DATA AND SHOP DRAWINGS

- A. GENERAL: PDF versions of brochures, shop drawings, and material lists as required by the specifications, shall be prepared and submitted to the Engineer for review within thirty days after award of the Contract. No work indicated on any one shop drawing shall be started until such drawings have been reviewed and accepted by the Engineer.
- B. Space is critical; therefore, equipment of larger sizes than shown, even though of an acceptable manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.
- C. Where equipment manufacturers named as equivalent or accepted as equal are proposed for use by the Contractor, he shall be responsible to coordinate the change with all trades affected. Contractor shall submit, for acceptance, 1/4 inch scale shop drawings for equipment rooms, plan and section, roof plan, etc.

1.11 PRODUCT DATA

- A. Contractors shall submit complete product data of all equipment to be installed.
- B. Contractors shall submit a list of all material as specified not covered by brochures or shop drawings.
- C. Submittal shall be indexed by specification section with table of contents. Data shall be referenced to section and paragraph numbers of the specifications and to fixture and equipment numbers listed or scheduled, and shall be assembled in numerical order of the specification sections and paragraphs. No consideration will be given to partial submittals. No submittal shall be accepted directly from supply house or manufacturer's representatives nor will substitutions be discussed with anyone other than the successful Contractor after the contract is awarded.

- D. All materials and equipment shall be submitted by manufacturer, trade name, and model number. The submittal shall include data requested in the individual sections. The Contractor shall not assume that applicable catalogs are available to the Architect's or Engineer's office. Maintenance and operating manuals and coded order forms are not suitable submittal material. Each sheet of printed material shall be clearly marked (using arrows, underlining, or circling) to show the particular sizes, types, model numbers, ratings, capacities, and options actually being proposed. Non-applicable material shall be crossed out. All specified features must be specifically noted on the submittal.
- E. Where the item is a substitution, the submittal must be complete with adequate proof of its quality equal to the item specified. Substitutions made because of installation problems, non-availability, later delivery, etc., shall be explained in the transmittal letter accompanying the submittal. Substitute items shall be accepted only under the following conditions: "Should the material or equipment fail or perform unsatisfactorily during the warranty period, this material and/or equipment shall be replaced with material or equipment specified by name in these specifications, at no additional cost to the Owner. Contractor shall PERSONALLY bring a sample of the substitute item to the Engineer office for his inspection at time submittals are made if Engineer requests same."
- F. When items are omitted from the submittal or if submittal is not received by the Engineer within thirty days of Contract date, it shall be construed to mean that only items specified by name and number shall be installed and no substitutions shall be accepted.
- G. In the event that submitted materials, appliances, etc., are not, in the opinion of the Engineer, in conformity with the specifications, the Engineer reserves the right to reject this equipment.
- H. If items other than those specified or approved as submitted are found installed on the project, they shall be removed and the specified items shall be installed at no cost to the Owner.
- I. Submittals shall be reviewed by the Engineer for conformance with design concept only. Review will not include deviations from detail requirements unless these deviations are specifically listed by the Contractor in writing and attached to the data. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements; construction criteria including all means and methods, materials, catalog numbers, and similar data for checking and coordinating with the requirements of the work. Quantities of materials and equipment will not be checked by the Engineer.

1.12 SHOP DRAWINGS

- A. Contract drawings are diagrammatic design drawings and are not intended as installation drawings. Each Contractor shall, within thirty days after award of contract, and prior to beginning any installations, prepare NEW AND ORIGINAL detailed shop drawings for the following as applicable to the project:
 - 1. Control Wiring Diagrams
 - 2. Interlock Wiring Diagrams
 - 3. Kitchen Electrical Rough-Ins
 - 4. Electrical Rooms, 1/4" scale, plan and sections.
 - 5. Electrical Trenches and routing of site electrical services (not less than full scale for site routing).
 - 6. Detail shop drawings for main switchgear.
 - 7. Special electrical systems such as fire alarm, sound systems, lightning protection, C.C.T.V., telephone, intercom, paging, etc.,
 - 8. and other critical spaces as directed by the Engineer, showing the exact location and dimensions, spacing and location of each piece of equipment, piping, and conduit.Reproduction of Engineer's design drawings shall not be considered as shop drawings.
- B. The Contractor shall coordinate to ascertain that there are no conflicts. The Contractor is responsible for rearrangement and revision required to dimensions, connection sizes, special installment requirements, horsepower, voltage, and phase of all equipment.

- C. Each trade, in cooperation with all other trades, shall determine, prior to commencing work, the sequence of the installation of all trades.
- D. In no case will wire to wire or terminal type of wiring diagrams for control system be included or checked as submittal; they shall be included as information only. Temperature control function diagram and written description only shall be accepted by the Engineer.
- E. The Contractor's responsibility includes, but is not limited to, obtaining and aptly applying all field measurements, construction criteria including means and methods, and materials and necessary coordination data for making all installations complete and operating to the full intent of the Contract Drawings and Specifications.
- F. Shop drawings shall be submitted to and approved by the Engineer prior to beginning of any installations. The Engineer will assist in resolving installation problems and conflicts only when furnished with complete shop drawings prepared by the Contractor for all phases of the work and only when the Contractor cannot solve a problem. When installations are made without submitting shop drawings, the Contractor is responsible for immediate correction at his own cost for conflicts and to installations contrary to the intent of design drawings.

1.13 CONSTRUCTION RECORD DRAWINGS

- A. Each Contractor shall purchase or obtain from the Architect/Engineer one complete set of final design documents of the Contract Drawings and shall record on these drawings all locations, dimensions, and depths of all buried and concealed piping and conduits, plugged outlets, and equipment. The master copy shall be maintained at the job site at all times and shall be marked daily as construction progresses. These drawings shall not be used for reference or construction but shall be available for the Engineer's review. No backfilling of trenches will be permitted until Record Drawings are approved as up-to-date.
- B. Depth of duct banks and other underground conduit prints shall be from a permanent bench mark which shall be shown on drawings.
- C. At completion of the work, the data on these prints shall be given to the Engineer of record and transferred electronically to CAD drawing format (if included in Engineer's scope of work). The electronic files shall then be copied to a CD for reproducible prints by the Contractor or building Owner, dated, marked "Record Drawings".

1.14 MANUFACTURER'S INSPECTION

- A. At the completion of work and before acceptance, an authorized representative of the manufacturers of electrical equipment shall personally inspect the installation and operation of his equipment to determine that it is properly installed and in good operating order. If equipment is to be concealed, the representative shall make his checks during the course of installation. The Contractor shall submit to the Engineer a statement signed by each manufacturer's accordance with the manufacturer's recommendations and is operating properly.
- B. Inspection shall include new distribution equipment, electrical gear, fire alarm, lighting controls, special systems, and such items as are specifically designated by the Engineer.

1.15 TESTING LABORATORY CERTIFICATION

- A. All equipment and materials where applicable shall be listed by Underwriters' Laboratories and shall bear the Underwriters' Laboratories label.
- B. All material, equipment, products furnished and installed on this project shall bear the label, symbol and other identifying mark of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled and/or listed equipment or material and whose listing of labeling states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner, when such label, symbol, or listing is available.

1.16 FIRE AND SMOKE DEVELOPMENT RATINGS OF MATERIALS

- A. All materials and products installed on this project shall have published fire and smoke developed ratings that conform with U.L. classifications and NFPA 90A and shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less and a fuel contribution rating of 50 or less.

1.17 ASBESTOS

- A. No product which contains asbestos shall be incorporated into any component of this Project.
- B. If asbestos is encountered in any existing installations, Contractor shall stop work immediately and notify the Owner. No work shall be commenced in the area containing asbestos until complete removal or abatement has been accomplished by Owner.

1.18 EXISTING UTILITY ELECTRICAL SERVICES

- A. The drawings indicate all known utility and drainage piping existing on the site of the work. Location of said piping is in accordance with information furnished to the Engineer by the Owner. Responsibility for locating, uncovering, disposing, or maintaining all existing utility conduit shall rest solely with the Contractor, who shall plan and conduct his operations in such a manner to insure safe conditions for the entire construction period.
- B. Existing underground electrical services shall be maintained in service unless otherwise noted. Contractor shall promptly repair all electrical services to be maintained in service, at no expense to the Owner, in the event that they are damaged as a result of his work of this project. All pull boxes, manholes, or other appurtenances of utilities which are to remain in service shall be raised or lowered to meet new finished grades as indicated on appropriate drawings.
- C. Make arrangements for connections to utilities required for the work as shown on drawings and pay all charges and fees in connection with any service connections, making installations complete in all aspects.
- D. Each Contractor shall furnish and install all materials, equipment, and labor required for finished, complete, and operating service connections. Contractors shall be responsible for making personal contact with proper officials of utility companies prior to bid opening and obtaining all details of service requirements and for including ALL costs for ALL requirements for complete services.
- E. Any detail requirements for utility metering and/or connections is specified hereinafter in the appropriate section.
- F. Existing utility conduit which is to be abandoned shall be completely removed where it occurs in the area of excavation. Abandoned conduit shall be plugged or capped in a manner acceptable to the Engineer. Existing manholes shown to be abandoned shall be filled with sand.
- G. Any minor adjustment in location or alignment of new work to avoid or to connect to existing utilities shall be performed as directed by the Engineer without additional cost to the Owner.

1.19 EXCAVATION AND BACKFILL

- A. Provide all excavation and backfill required for work of this section, in accordance with applicable requirements of Division 31 - Earthwork Section. Coordinate disposition of building materials to avoid interference with all other work.
- B. Provide barricade protection and shoring as required for safety.
- C. Do not backfill until after testing and inspection of installed conduit work.
- D. All plants, turf, and surfacing that occur in the areas of the excavation shall be carefully removed and placed where they will not be damaged. After the excavations are filled, the plants, turf, and surfacing shall be replaced as directed. All sidewalks, driveways, or other cement or asphalt surfaces which are damaged during excavating shall be repaired to match the adjacent work in material and finish and in accordance with requirements established by authorities having jurisdiction over subject walks, lawns, or streets.

- E. Provide clearance (12 inches minimum) under suspended conduit under the building. The Contractor shall be responsible for necessary excavation to obtain such clearance and if such clearance is not found to exist at the completion of the project, the Contractor shall excavate as required to meet this specification.
- F. Conduit trenches not under the building shall be parallel to building lines unless otherwise noted on drawings.
- G. Trenches shall be cut a minimum of six inches (6") below required depth to allow for bedding material. All conduit shall have a minimum cover of 24 inches unless otherwise noted or accepted. Trenches shall be a minimum of SIX inches (6") wide and not less than FOUR inches (4") wider than outside diameter of a single conduit being installed. When more than one conduit is installed in a trench, the trench shall be widened appropriately to allow the conduit to be laid side-by-side with a minimum of FOUR inches (4") of sand between each conduit. In no case shall different services be installed one above the other. Piping and/or conduit of various trades shall NOT be installed in same trench unless permission is granted by the Engineer. Where required by depth and/or type of soil, trenches shall be properly and adequately shored to prevent cave-ins and slides.
- H. Properly backfill, flood, and tamp all excavations to the finished grade AFTER the conduit has been observed and accepted. The backfill for all conduit may be excavation material, except that at least six inches (6") of clean pit run sand shall be placed over the pipe and six inches (6") of sand below the pipe. A minimum of 12 inches of sand is required for all conduit. Backfill shall be placed in six inch (6") layers, wetted and compacted to the density of adjacent soil. Continue this process until trenches are completely backfilled. Surplus materials shall be hauled from the project. Where trench backfill settles below finished grade during the one year guarantee period, the Contractor shall take necessary steps to correct same as accepted by the Engineer.
- I. Trenches backfilled prior to observation of conduit by the AHJ shall be reopened as directed by the AHJ.

1.20 OPENINGS: CUTTING, REPAIRING

- A. Holes in Concrete: Sleeves shall be furnished, accurately located, and installed in forms before pouring of concrete. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the acceptance of the Structural Engineer prior to cutting or drilling. No cutting or boring of structural members shall be done without WRITTEN permission of the Structural Engineer.
- B. Verify that all chases and openings are properly located.
- C. Damage to existing facilities shall be repaired as required to restore these facilities to their original condition. All openings through floor, ceilings, walls, etc., shall be sealed rat and insect-proof, whether exposed to view or within walls, with a fire resistant sealant.

1.21 CONCRETE WORK

- A. Provide concrete equipment bases for switchboards, power distribution panels, motor control centers, floor mounted electrical panels, transformers, etc. Provide anchors and all conduit supports in trenches.
- B. Furnish all required templates for anchor bolts and dimension drawings for housekeeping pads. All concrete shall be in accordance with that specified under Division 03 - Concrete of the Specifications.

1.22 MANNER OF RUNNING PIPE AND CONDUIT

- A. All conduits shall be concealed in chases, walls, furred spaces, or above the ceilings unless otherwise noted.
- B. In mechanical/electrical rooms, janitor's closets, or other storage spaces, where necessary, conduit may be run exposed. Exposed conduit shall be run in the neatest, most inconspicuous manner and parallel to building lines. Conduit shall be run high as possible when exposed in

rooms.

- C. No conduit shall be installed in structural concrete slabs, beams, walls, or concrete structure without prior approval unless specifically noted on the drawings.

1.23 EQUIPMENT AND CONNECTIONS

- A. All apparatus, equipment, devices, and appliances which are indicated to have electrical connections shall be so equipped.

1.24 MOTORS AND CONTROLS

- A. Motors less than one horsepower shall be 115 volts or 200/230 volts, single phase, with built-in thermal protection and shall be furnished with manual or magnetic starters as required, unless otherwise noted on drawings.
- B. The Contractor shall furnish a suitable motor starter with the necessary number of auxiliary contacts required for the use with the proper type of switch controls in the cover. Motor starters shall be equal to Furnas, Siemens, General Electric, Cutler-Hammer, or Square D, with three leg overload protection; except special requirements for motor starters shall be specified under the particular piece of equipment requiring starter. Mounting of motor starters and wiring shall be installed under Electrical Division.

1.25 ELECTRICAL WIRING OF TEMPERATURE CONTROL EQUIPMENT

- A. The Contractor shall be responsible for complete installation of all the automatic temperature control wiring. All power wiring, interlock wiring as required, starter connections, and disconnect switches shall be installed under Electrical Division. Control wiring shall be a minimum of No. 18 AWG and shall be copper with THW or THWN-THHN insulation. Control wiring shall be installed in EMT conduit when above grade, PVC when below. See applicable section for conduit specifications.
- B. Mechanical contractor shall provide necessary wiring diagrams showing power wiring, interlock wiring, and temperature control wiring which shall be used for making the control wiring and interlock wiring installations.
- C. At the completion of all construction work, there shall be a meeting at the job site of all parties involved, who shall inspect, test, and check each control circuit, interlock circuit, and power circuit for all equipment and shall determine by mutual agreement that all equipment is properly wired for the operations intended. A letter to this effect, signed by all three parties, shall be furnished to the Engineer at the time of final inspection. This letter shall read as follows:
 - 1. "We, the undersigned authorized representatives of the Contractor, hereby certify that we have met together at the site and have by test and check found that entire temperature control system and interlock wiring systems are properly installed and wired and all items are functioning in accordance with design requirements and Contract Drawings and Specifications."

1.26 CLEAN-UP

- A. All unused material and debris resulting from the performance of work shall be removed from the premises as it accumulates.

1.27 HOISTING, SCAFFOLDING, AND TRANSPORTATION

- A. Furnish hoisting facilities to set materials and equipment in place and provide scaffolding, ladders, and facilities for equipment installations and for adjustment and balancing, installation of grilles, and cleaning of fixtures and devices. Provide transportation to deliver materials, equipment, tools and labor to perform the work.

1.28 SLEEVES FOR ALL CONDUITS

- A. For conduits through outside walls above grade, install Schedule 40 GALVANIZED steel pipe sleeves having an inside diameter of 1-1/2 inches greater than the outside diameter of piping being installed. Sleeves shall be flush with each wall surface.

- B. Where conduits pass through floors not on fill, 22 gage GALVANIZED sheet metal sleeves shall be used. In concrete floors they shall extend one inch above the floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least one inch (1") greater than outside diameter of insulation. Sleeves shall be set before concrete is poured.
- C. Sleeves in footings, grade beams, under sidewalks, drives, and elsewhere noted on drawings shall be Schedule 40 PVC plastic pipe with chemical weld joints. Use long sweep ells where conduit turns are made.
- D. Where conduit passes through a concrete wall, beam, or floor below grade or below ground water level, a through-wall or floor seal shall be installed. Sealing fitting shall be installed in concrete forms before concrete is poured. Fitting shall be O-Z / Gedney Type FSK where sealing is required on one side of wall only and Type WSK where sealing on both sides of wall is required. Installation shall be in accordance with manufacturers' instructions.
- E. The annular space around conduits and sleeves shall be filled with a fire resistant sealant as specified hereinafter. Both sides of wall, floor, ceiling, or roof shall be sealed to the satisfaction of the Engineer whether exposed to view or within walls. ALL openings around conduits shall be insect, vermin, and rodent proof.

1.29 ROOF PENETRATIONS AND FLASHINGS

- A. Refer to Specification Division 07 – Thermal and Moisture Protection.

1.30 SEALING OF PENETRATIONS (FIRE STOPPING)

- A. Seal all small openings in floors, walls, ceilings, etc. around conduit, cables, etc. with Dow Corning Fire Stop Sealant System, 3M Fire Barrier 2000+ Silicone Sealant Systems, or approved equal, in conformance with U.L. testing procedures.
- B. Seal all openings larger than 1/4" around conduit, etc., through roof, walls and floors above grade with a two-part foam, or one-part sealant material approved by the Engineer, at least 1-1/2" thick, that will form a watertight, vermin-tight barrier that is capable of containing smoke and fire up to 2000 deg. F. for two hours. Fire and smoke barrier will be required in all floors above grade of multi-story buildings and in all walls of fireproof construction. All empty holes and all large openings around conduit, cables, etc., shall also be filled with two-part fire stopping materials. One-part may be used for single penetrations at sleeves and fire rated expansion joints.
- C. The firestopping system shall be materials that expand to fill cavities or provide adhesion to substrates, and that will maintain seal under normal expected movement of substrates. MATERIAL SHALL NOT REQUIRE A RISE IN TEMPERATURE TO INSTALL OR ACTUATE THE SEAL. Fire Stop Systems shall utilize materials that are UL Classified as "Fill, Void, or Cavity Materials" and "Through Penetration Firestop Systems." Materials shall have been tested in accordance with ASTM E814 "Methods for Fires Tests of Through-Penetration Firestops" and UL 1479 "Fire Tests of Through-Penetration Firestops."
- D. Mineral fiber board, mineral fiber matting and mineral fiber putty may be used as forming and damming for the foam and may be left in place as an integral part of the seal if of a fire rated material. Plywood, particle board, or other combustible foaming and damming materials shall be removed after foaming is completed.
- E. Foam exposed in finished areas shall be neatly trimmed flush with the finish surface. In traffic areas, foam sealed areas shall be covered with a traffic surface approved by the Architect.
- F. Application of foam in penetrations shall be made in accordance with the manufacturer's recommended procedure. Upon completion of the installation, the openings around all penetrations shall be airtight to prevent passage of water, smoke, fire or vermin. Proper installation shall be verified by proper color change and cell structure of cured foam.
- G. Damming materials shall be removed after foam has cured for 24 hours if of other than fire sensitive materials. Seal all voids that have developed in foam with Dow Corning RTV sealant as required to provide full coverage.

- H. Inspect penetration seals after 24 hours and inject additional foam where required for a tight seal. Reinspect after added foam has cured 24 hours. Cut and trim cured foam with sharp knife as required for finished appearance.
- I. Nelson Flameseal Putty, Flamemaster (Flamastic 77), and Thomas & Betts Flamesafe Fire Stop System may be acceptable products for sealing of penetrations provided they are installed according to manufacturer's recommendations and are approved by the Engineer prior to installation.

1.31 FLOOR AND CEILING PLATES

- A. Furnish and install chromium plated escutcheon plates around conduits passing exposed through walls, floors, or ceilings. Plates shall be sized to fit outside of pipe or sleeves and/or insulation and shall fit snugly. Plates shall fit around sleeves where they extend through the floor. Solid chromium plated plates with set screws shall be installed on any conduit where split ring or compression type plates will not stay in position.
- B. Where bus ducts or cable trays pass through walls, floors, or ceilings, install sheet metal collars to cover the void around the duct where fire barrier is not required.

1.32 TESTS AND ADJUSTMENTS

- A. No conduit work, fixtures, or equipment shall be concealed or covered until they have been observed by the Engineer, who shall be notified a minimum of 48 hours in advance. All work shall be completely installed, tested as required by this section and the City and State Ordinances, and shall be repeated upon request to the satisfaction of the Engineer's representative.
- B. Test gages shall have been calibrated for accuracy within three (3) months of date tests are made. Evidence of calibration shall be available to Engineer upon request.
- C. Test gages shall have a range such that the test pressure will fall at mid-range of dial.
- D. Test Procedures shall be applied for minimum periods noted and until tests are complete.
- E. The Engineer shall be notified 48 hours prior to each test and other specification requirements requiring action by the Engineer. All tests shall be made in presence of the City Inspector and/or Engineer's representative.
- F. Maintain written logs of all tests specified above.

1.33 OPERATION TEST

- A. At completion of installations, Contractor shall operate all electrical and special systems for a period of at least two days of eight hours each to demonstrate fulfillment of the requirements of the Contract. During this time, all adjustments shall be made to the equipment until the entire system is in satisfactory operating condition acceptable to the Engineer.

1.34 FINAL OPERATION AND INSTRUCTION

- A. Upon completion of the installation of the equipment and after final acceptance, and on Engineer's request, the Contractor shall place a competent person at the building who shall operate the plant for a period of one eight hour day, instructing the Owner in all details of operation and maintenance. This requirement is in addition to "Operation Test" specified above.
- B. Any required instructions from manufacturer's representatives shall be given during this period. The time specified under "Operation Test" will not substitute for the one day of final operation and instruction.

1.35 OPERATION

- A. The Owner may require operation of parts of all of the installation for beneficial occupancy prior to final acceptance.
- B. Cost of utilities for such operation shall be paid by the Owner. Said operation shall not be construed as acceptance of the work; however, Contractor shall obtain written agreement with

Owner regarding beginning date for warranty and guarantee purposes. Unless such agreement is obtained, warranties and guarantees shall go into effect upon completion.

1.36 DAMAGE BY LEAKS

- A. The Contractor shall be responsible for damages to the grounds, walks, roads, buildings, piping systems, electrical systems and their equipment and contents, caused by leaks by this Contractor as a part of this Contract. He shall repair, at his expense, all damage so caused. All repair work shall be done as directed by the Engineer.

1.37 EMERGENCY REPAIRS

- A. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond or relieving the Contractor of his responsibilities during the Contract period.

1.38 REQUIREMENTS FOR FINAL ACCEPTANCE OF PROJECT

- A. All of the following items must be completed prior to final acceptance of project. No exceptions will be made and no final acceptance of payment will be made until all items are completed.
 - 1. CLEANING EQUIPMENT AND PREMISES:
 - a. Thoroughly clean all parts of the conduit and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease; adhesive labels, and foreign materials shall be removed. Surfaces shall be carefully wiped.
 - b. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.
 - c. Electrical device covers shall not be installed until finish coat of paint is completed. Device handles and receptacles shall be covered and/or protected during the painting operation to preserve the original factory finish.
 - 2. DEFICIENCY LISTS: Correct all deficiencies listed at time of Substantial Completion.
 - 3. OWNER'S OPERATING AND SERVICE MANUAL: Submit, at least ten days prior to Final Acceptance, one copy of the Owner's Manual to the Engineer for his acceptance. Following the Engineer's acceptance, prepare PDF manual and one paper copy of bound, indexed, Owner's Manual to be delivered at time of Final Acceptance, which shall include but not be limited to the following:
 - a. System operating instructions.
 - b. System control drawings.
 - c. System interlock drawings.
 - d. System maintenance instructions.
 - e. Material and equipment lists.
 - f. Serial numbers of all principal pieces of equipment.
 - g. Manufacturer's, suppliers', and subcontractors' names, addresses, and telephone numbers; both local representatives and manufacturers' service headquarters.
 - h. Equipment operating and maintenance instructions and parts lists.
 - i. Certified performance curves.
 - j. Manufacturer's certification.
 - k. Balancing and performance test report.
 - l. Complete electrical load data from operation test.
 - 4. INSTRUCTIONS:
 - a. All verbal instructions as herein specified shall have been performed.
 - b. Provide the following:
 - 1) System operating instructions.
 - 2) System control drawings.
 - 3) System interlock drawings.
 - 5. CERTIFICATIONS: Provide PDF and one bound copy containing the following:
 - a. Performance Test Report.

- b. Manufacturer's certifications.
 - c. Contractor's guarantees.
 - d. Owner's acknowledgment of receipt of instruction, enumerating items in Owner's Manual. List of manufacturers' guarantees executed by the Contractor (those extending beyond one year.)
6. RECORD DRAWINGS: Deliver the specified record drawings to the Engineer.
7. Furnish the services of an Engineer or Technician acceptable to the Engineer to instruct the Owner's authorized representative in the complete and detailed operation of each and every system and piece of equipment. Instructions shall be conducted for the period of time necessary to thoroughly familiarize Owner's personnel and to accomplish the desired results. Upon completion of these instructions to the Owner, provide a letter to the Owner signed by him stating dates and names of personnel giving instruction and those receiving instruction. NOTE: One copy of these letters shall be included in data to be furnished for final acceptance and shall be sent directly to the Engineer.

1.39 GUARANTEES AND WARRANTIES

- A. The Contractor shall guarantee to the Owner that all labor, materials furnished, and work performed are in accordance with the contract, contract drawings, specifications, authorized alterations, and additions. Should any defect develop during the contract guarantee period due to improper materials, workmanship, or arrangement, the same together with any other work affected in correcting such defect shall be made good by the Contractor without expense to the Owner.
- B. The materials and equipment shall be warranted to be free from defects by the manufacturer. Any defect that develops or failure that occurs during the contract guarantee period together with any other work affected in correcting such defect or failure shall be made good by the Contractor without expense to the Owner. Manufacturer and Contractor shall include cost of labor in the warranty of all equipment.
- C. The contract guarantees and warranty periods shall be from the date the complete facility is accepted by the Owner, unless other dates are mutually agreed upon between Owner and Contractor.
- D. The Contractor's work shall be guaranteed for a minimum of **one year** unless noted otherwise in specific sections of these specifications.
- E. The materials and equipment shall be warranted for a minimum of one year. Some components may be specified with or normally have longer standard warranty periods. In this case, the longer warranty period shall be provided by the Contractor.

1.40 DEMOLITION AND RELOCATION (WHERE APPLICABLE)

- A. The Contractor shall remove and/or relocate, modify, or reinstall all items as indicated on drawings or required by the installation of new materials, equipment, and outlets. All removal and/or salvage and all materials and equipment shall remain the property of the Owner and shall be stored at such locations on site as designated by the Owner.
- B. All waste, trash, debris and other such unusable items shall be promptly removed from the site and disposed by the Contractor.
- C. All items of equipment to be relocated shall be thoroughly cleaned, inspected, and reinstalled in a proper manner by workmen skilled in the trade and in conformance with standard practice of trade involved. Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore item to good operation. Should equipment designated for relocation be found to be damaged and/or unsuitable for relocation, it shall be called to the attention of the Engineer prior to dismantling for further instructions before removal. Items damaged during removal and/or storage are the responsibility of the Contractor and shall be replaced or repaired by him in a manner acceptable to the Owner. After reinstallation, items shall be "fire-tested" and/or given operational tests and put back into proper working order. Service piping and/or wiring to items

to be removed or relocated shall be removed to points at which reuse is to be continued or service is to remain. Services not reused shall be capped, sealed, or otherwise cut-off or disconnected in a safe manner acceptable to the Owner and shall be done in such a manner to result in a minimum of interruption to services of adjacent occupied areas. Services to existing occupied areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specified acceptance of the Owner and a time schedule accepted by him for the cut-off period.

- D. The Contractor shall be responsible for the loss or damage of existing facilities caused by him or his workmen and shall be responsible for repairing all damage and the replacement of such losses. The Contractor shall erect such temporary barricades, with necessary safety devices as required, to protect working personnel and/or others from injury and shall remove such temporary protection upon completion of the project. Where existing construction is removed to provide working access to existing utilities and where partitions, walls, floors, and ceilings are removed, the Contractor shall remove and reinstall in locations accepted, all devices required for the complete final system in each and every respect. Contractor shall provide temporary service facilities to all equipment which must remain in operation during the construction period and shall make such necessary arrangements, send proper notices, and perform all such services as required to maintain in service operation all electrical and special systems in all new and existing areas as required for the continuing operation of the facility being remodeled.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop and/or NEC required deratings.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.

- 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
2. In addition to other applicable restrictions, may not be used:
 - a. Where exposed to view.
 - b. Where exposed to damage.
 - c. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Provide new conductors and cables manufactured not more than one year prior to installation.
- C. Comply with NEMA WC 70.
- D. Conductor Material:
 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Tinned Copper Conductors: Comply with ASTM B33.
- E. Minimum Conductor Size: 12 AWG.
 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 4) Intent is to limit branch circuit voltage drop (panel to device) to 3% or less..
 2. Control Circuits: 14 AWG.
- F. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- G. Conductor Color Coding:
 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray with white stripe.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White with black stripe.
 - c. 240/120 V, 1 Phase, 3 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Neutral/Grounded: White.
 - d. Equipment Ground, All Systems: Green.

- e. Travelers for 3-Way and 4-Way Switching: Pink.
- f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Encore Wire Corporation: www.encorewire.com/#sle.
 - b. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - c. Southwire Company: www.southwire.com/#sle.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Grounding: Full-size integral equipment grounding conductor.
- G. Armor: Aluminum or steel, interlocked tape.
- H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:

1. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. Thomas & Betts Corporation: www.tnb.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

- A. Electrical Tape:
 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant:
 1. Listed and labeled as complying with UL 267.
 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 3. Suitable for use at installation temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage wire and cable has been completed.
- B. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced

conductors.

1. Wet Locations: Use heat shrink tubing.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.
- N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 26 0553.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is only required for services and feeders. The resistance test for parallel conductors listed as optional is not required.
 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect or Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 10 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method or alternate test described in IEEE 81.
- E. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and

other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 - c. Metal process piping.
 8. Provide bonding for metal building frame.
- F. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from building grounding electrode system to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: 1/4" x 4" x 24" unless otherwise indicated or required.
3. Holes for Connections: As indicated or as required for connections to be made.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Make grounding and bonding connections using specified connectors.
 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- D. Identify grounding and bonding system components in accordance with Section 26 0553.
- E. Reference grounding details on drawings for additional information.

3.02 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except independent testing is not required.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

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**SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.2. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Do not use wire, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 - 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 2. Comply with MFMA-4.
 - 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Plastic and lead anchors are not permitted.
3. Hammer-driven anchors and fasteners are not permitted.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect or Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect or Engineer, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3.5 in high concrete pad constructed in accordance with Section 03 3000.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.
- I. Cable Tray Support and Attachment: See Section 26 0536 for additional requirements.
- J. Box Support and Attachment: See Section 26 0533.16 for additional requirements.
- K. Busway Support and Attachment: See Section 26 2513 for additional requirements.
- L. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.
- M. Exterior Luminaire Support and Attachment: See Section 26 5600 for additional requirements.
- N. Secure fasteners in accordance with manufacturer's recommended torque settings.
- O. Remove temporary supports.

3.02 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 8400 - Firestopping.
- C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 0529 - Hangers and Supports for Electrical Systems.
- F. Section 26 0533.16 - Boxes for Electrical Systems.
- G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect or Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.05 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, request additional information from engineer.
- C. Underground and Slab-on-Grade:
1. Minimum Size: 1 inch. (1/2 inch when crossing within concrete slabs)
 2. Use nonmetallic conduit.
 3. PVC coated Rigid Galvanized Steel Rigid Metal Conduit Sweeps and Risers for all conduit greater than 1" in diameter.
 4. Under Slab on Grade: Use rigid PVC conduit.
 5. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
 6. Where rigid polyvinyl (PVC) conduit is provided, transition to rigid conduit of appropriate type where emerging from underground.
 7. Where rigid polyvinyl (PVC) conduit larger than 1 inch trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.
 8. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use PVC corrosion protection tape or factory-applied corrosion protection coating acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- D. Embedded Within Concrete:
1. Within Slab on Grade when slab thickness greater than 5 inches.: Use nonmetallic conduit.
 2. Within Slab Above Ground when slab thickness greater than 5 inches: Use nonmetallic conduit. EMT is allowed when not in direct contact with earth..
- E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit, galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- F. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- G. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).
- I. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit.
- J. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit.
- K. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 3. Maximum Length: 6 feet unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- L. Dry Locations:
1. Concealed: Use electrical metallic tubing.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.
- D. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4-inch trade size.
 - 3. Control Circuits: 1/2-inch trade size.
 - 4. Flexible Connections to Luminaires: 3/8-inch trade size.
 - 5. Underground, Interior: 1 inch (27 mm) trade size.
 - 6. Underground, Exterior: 1-inch trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
 - 2. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

2.07 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. ABB; Ocal: www.electrification.us.abb.com/#sle.
2. Calbond, a division of Atkore International www.calbond.com/#sle
3. Robroy Industries: www.robroy.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. PVC-Coated Boxes and Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.08 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2.09 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2.10 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Connectors and Couplings: Use set-screw type.
 - a. Do not use indenter type connectors and couplings.
3. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
4. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are not acceptable.

2.11 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Connectors and Couplings: Use compression/gland or set-screw type.

2.12 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.13 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- E. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- F. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:

- a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 8. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 9. Arrange conduit to provide no more than 150 feet between pull points.
 10. Route conduits above water and drain piping where possible.
 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 14. Group parallel conduits in same area on common rack.
 15. Coordinate routing of exposed conduit routing with owner/architect prior to installation.
- H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
 9. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 7. Secure joints and connections to provide mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 8400.
- K. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 18 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 3/4-inch trade size unless otherwise approved.
 2. Install conduits within middle one third of slab thickness.
 3. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 3000.
- N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- O. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- Q. Provide grounding and bonding; see Section 26 0526.
- R. Identify conduits; see Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Boxes for hazardous (classified) locations.
- E. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Keys for Lockable Enclosures: Two of each different key.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 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 as suitable for the purpose intended.
 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 for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast iron boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use suitable concrete type boxes where flush-mounted in concrete.
 5. Use suitable masonry type boxes where flush-mounted in masonry walls.
 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 7. Use shallow boxes where required by the type of wall construction.
 8. Do not use "through-wall" boxes designed for access from both sides of wall.
 9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 13. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
 - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
 - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 14. Wall Plates: Comply with Section 26 2726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.

- b. Outdoor Locations: Type 3R, painted steel.
- 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
- 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed same as panelboards unless otherwise indicated.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.
 - 1. Manufacturers:
 - a. Hubbell Incorporated: www.hubbell.com/#sle.
 - b. Legrand.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 - 2. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - 3. Locate boxes so that wall plates do not span different building finishes.
 - 4. Locate boxes so that wall plates do not cross masonry joints.
 - 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - 8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

9. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- I. Box Supports:
 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 0526.
- R. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.04 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for electrical equipment
 - 1. See drawings for typical identification nameplate detail.
 - 2. Use identification nameplate or identification label to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) If short circuit rating was determined by series rating per manufacturer tables, identify such panelboard as "SERIES RATED"
 - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 5) For power panelboards without a door, use identification label to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Transformers:
 - 1) Identify power source and circuit number. Include location when not within sight of equipment.
 - 2) Identify load(s) served. Include location when not within sight of equipment.
 - c. Enclosed switches and circuit breakers rated 60A or greater:
 - 1) Identify voltage and phase.

- 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 3. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
 4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
 5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
 - a. Provide red lock-on clip equal to Space Age Electronics #ELOCK-FA.
 6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Motor control centers.
 - c. Elevator control panels.
 7. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
 - b. Service Equipment: Include the following information in accordance with NFPA 70.
 - 1) Nominal system voltage.
 - 2) Available fault current.
 - 3) Date label applied.
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
 2. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 3. Use underground warning tape to identify direct buried cables.
- C. Identification for Raceways:
 1. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 2. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
 1. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the following color code:
 - 1) Fire Alarm System: Red.

2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, provide identification on inside face of cover.
- E. Identification for Devices:
 1. Identification for Communications Devices: Comply with Section 27 1000.
 2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
 3. Use identification label to identify fire alarm system devices.
 4. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

- A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

**SECTION 26 0923
LIGHTING CONTROL DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Outdoor photo controls.
- D. Lighting Relay Panels
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0533.16 - Boxes for Electrical Systems.
- B. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
 - 1. Includes finish requirements for wall controls specified in this section.
 - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with supply diffusers, millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.Notify Architect or Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Operation and Maintenance Data: Include detailed information on device programming and setup.

1.05 QUALITY ASSURANCE

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

1.06 WARRANTY

- A. Provide five year manufacturer warranty for all components.

1.07 EXTRA PARTS

- A. Furnish three (3) spare of each occupancy sensor type, power pack, and/or replaceable relay.
- B. Furnish one (1) spare exterior photocell.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.

- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 3. Sensor Switch Inc: www.sensorswitch.com/#sle.
 4. WattStopper: www.wattstopper.com/#sle.
 5. Leviton.
 6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- B. All Occupancy Sensors:
1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 2. Occupancy/Vacancy sensor types and application.
 - a. Dual Technology to be utilized in open office, restrooms with stalls, and similar areas without direct line of sight between occupants and sensor.
 - b. Passive Infrared (PIR) to be utilized in all cases, other than dual technology areas listed above.
 - c. All ultrasonic sensors or dual technology sensors shall remain at least 5ft from any supply air diffuser to reduce nuisance tripping.
 - d. Care should be given to limit sensors from sensing motion through open doors. i.e. Utilize a corner mount sensor rather than a ceiling mount sensor.
 3. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 4. Sensitivity: Field adjustable.
 5. Compatibility (Non-Dimming Sensors): Suitable for controlling LED lighting, incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 6. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 7. Where wired sensors are indicated, wireless sensors are not acceptable without prior approval of Architect.
- C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
 3. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- D. Wall Dimmer Occupancy Sensors:
1. General Requirements:

- a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
 - b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- E. Ceiling Mounted Occupancy Sensors:
 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Finish: White unless otherwise indicated.
 2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
- F. Power Packs for Low Voltage Occupancy Sensors:
 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 4. Load Rating: As required to control the load indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect or Engineer to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
- E. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.04 FIELD QUALITY CONTROL

- A. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area.
- B. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect or Engineer.
- C. Adjust position of directional occupancy sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) occupancy sensor lenses to block undesired motion detection.
- E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect or Engineer.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

- A. Manufacturer shall provide field startup and commissioning on all lighting control systems.

3.08 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to Architect or Engineer, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 2. Provide minimum of two hours of training.
 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 4. Location: At project site.

END OF SECTION

**SECTION 26 2726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Notify Architect or Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes are complete.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 - 1. Wall Dimmers: Include derating information for ganged multiple devices.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Keys for Locking Switches: Two of each type.
 - 2. Extra Wall Plates: One of each style, size, and finish.

1.05 QUALITY ASSURANCE

- A. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated. Architect to confirm all finishes during submittals.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with stainless steel wall plate.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Industrial specification grade, 20A, 125V

2. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.04 WALL DIMMERS

- A. Manufacturers:
 1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with slide on/off control.
- D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

2.05 RECEPTACLES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell.com/#sle.
 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 1. Industrial specification grade, 20A, 125V
 2. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 3. NEMA configurations specified are according to NEMA WD 6.
- C. GFCI Receptacles:
 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
- D. Special and/or Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.06 WALL PLATES

- A. Manufacturers:
 1. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover

closed.

- F. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- C. Test each receptacle to verify operation and proper polarity.
- D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 26 2813
FUSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 2816.16 - Enclosed Switches: Fusible switches.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Enclosed Switches: See Section 26 2816.16.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect or Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.
- B. Littelfuse, Inc: www.littelfuse.com/#sle.
- C. Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes, 250V L-L or less: Class RK1, time-delay.
 - 2. Fusible Switches up to 600 Amperes, greater than 250V L-L: Class J, time-delay.
 - 3. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits and Single Phase Motors: Class RK5, time delay.
 - 1. Where appropriate fuse holders are provided, Class CC fuses are acceptable.
- D. Individual Motor Branch Circuits: Class RK5, time-delay.
- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 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. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Provide the following accessories where indicated or where required to complete installation:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Identify spare fuse cabinet in accordance with Section 26 0553.

END OF SECTION

**SECTION 26 2816.16
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 - Fuses.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Horsepower Rating: Suitable for connected load.
- D. Voltage Rating: Suitable for circuit voltage.
- E. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- F. Provide with switch blade contact position that is visible when the cover is open.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Provide solidly bonded equipment ground bus in each enclosed safety switch, 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.
- J. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- K. Heavy Duty Switches:
 1. Comply with NEMA KS 1.
 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- L. Provide the following features and accessories where indicated or where required to complete installation:
 1. Hubs: As required for environment type; sized to accept conduits to be installed.
 2. Integral fuse pullers.
 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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**SECTION 26 5100
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Ballasts and drivers.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.
- B. Section 26 0533.16 - Boxes for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 5600 - Exterior Lighting.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Notify Architect or Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
- C. Samples:
 - 1. Provide one sample(s) of each specified luminaire where indicated.
 - 2. Provide one sample(s) of each luminaire proposed for substitution upon request.
 - 3. Provide one sample(s) of each product finish illustrating color and texture upon request.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
 - 2. Extra Ballasts/Drivers: Two percent of total quantity installed for each type, but not less than one of each type.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 WARRANTY

- A. Provide five year manufacturer warranty for LED luminaires, including drivers.
- B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See lighting fixture schedule notes. If substitution intent is not noted, contractor shall assume equals will be evaluated during the submittal phase..

2.02 LUMINAIRES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- C. 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.
- D. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- E. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- F. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing provided from the factory; finish shall match the fixture. Coordinate the exact length during submittals. No field cutting of stems.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 26 0529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, suspended life safety egress light fixtures shall be provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
 - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
- H. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.
- M. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding

manufacturer's recommended maximum conductor length to luminaire.

- N. Install lamps in each luminaire.
- O. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect or Engineer.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect or Engineer. Secure locking fittings in place.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect or Engineer, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 27 0500
LOW VOLTAGE SERVICE, PATHWAYS, AND WIRING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Telecom, AV, Access Control and CATV distribution cable raceway system.
- B. Equipment and terminal backboards, and 120VAC and greater power for all systems.

1.02 REFERENCES

- A. EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.
- B. NFPA 70 - National Electrical Code.
- C. Applicable individual utility company regulations and installation criteria.

1.03 GENERAL LOW VOLTAGE SCOPE

- A. See electrical cover sheet for additional information regarding low voltage scope.

1.04 SYSTEM DESCRIPTION

- A. Service Building Entrance Pathway: Underground nonmetallic conduit and/or overhead EMT conduit from point of existing or new low voltage service point or pedestal to new building service terminal main backboard as indicated on Drawings and as required. Main low voltage service into buildings shall be by low voltage utility company. Closely coordinate installation requirements with Owner and utility company. Contractor shall provide all pathways between main equipment board and sub equipment board locations.
- B. Backbone Pathway: In conduit. Conform to EIA/TIA 569 using raceway as indicated and as specified.
- C. Horizontal Pathway: Via J-Hooks and/or D-Rings when above ceiling. All wiring routing through exposed ceilings shall be run in conduit – paint to match. Conform to EIA/TIA 569, using raceway as indicated and as specified.
- D. Premises Wiring: By Owner from low voltage equipment to each device outlet/coverplate (by Owner), using pull cords and complete raceway system by Contractor.
- E. Active equipment (switches, routers, DVRs, etc.) shall be by Owner. Contractor shall provide 120VAC and greater power where required by Owner, coordinate.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations and sizes of all pathways and device outlet locations, and system type.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with Owner and applicable utility company rules and regulations.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish Products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT TERMINATION BACKBOARDS

- A. Material: Plywood, grade BC, painted with matte white enamel as per Architect and Division 9.
- B. Size: As indicated and as required by Owner and Utility (where applicable), 3/4 inch thick.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate with all low voltage system vendors to provide all required raceway, backbox, and 120V power prior to installation of low voltage system components. All rough-in is electrical contractor's responsibility.
- B. Finish paint termination backboards with durable matte white enamel under the provisions of Division 9 prior to installation of Telecom equipment.
- C. Support raceways, backboards, and cabinets under the provisions of Section 26 0529
- D. Install termination backboards, and attach securely to building wall at each corner.
- E. Install polyethylene pulling string in each empty system conduit over ten feet in length or containing a bend. Identify and label each end of all pull cords.
- F. Mark all backboards and cabinets with the legend "TELECOM" or "CATV" under the provisions of Section 26 0553.
- G. Coordinate with fire rated walls. All cabling passing through fire rated walls shall have a fire stop assembly equal to STI Easy Path.
- H. All cabling passing through non-rated walls to deck shall be provided with conduit sleeves with bushings on each end.

END OF SECTION