

Southcentral Foundation Specialty Leadership Team ICT Remodel

100% Specifications

Architects Alaska Job Number: 21003.04

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TABLE OF CONTENTS

SECTION SECTION TITLE

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00	SUMMARY OF WORK
01 20 00	PRICE AND PAYMENT PROCEDURES
01 23 00	ALTERNATES
01 25 00	SUBSTITUTION PROCEDURES
01 26 00	CONTRACT MODIFICATION PROCEDURES
01 30 00	ADMINISTRATIVE REQUIREMENTS
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 40 00	QUALITY REQUIREMENTS
01 40 10	CLEAN CONSTRUCTION PROCEDURES
014010.01	INFECTION CONTROL RISK ASSESSMENT CONSTRUCTION PERMIT
01 41 00	REGULATORY REQUIREMENTS
01 42 00	REFERENCE STANDARDS AND DEFINITIONS
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 70 50	EXECUTION AND CLOSEOUT REQUIREMENTS
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 76 10	TEMPORARY PROTECTIVE COVERINGS
01 79 00	DEMONSTRATION AND TRAINING

DIVISION 02 – EXISTING CONDITIONS

024119	SELECTIVE DEMOLITION
--------	----------------------

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

064116	PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS
--------	---

DIVISION 9 – FINISHES

096513	RESILIENT WALL BASE AND ACCESSORIES
096813	TILE CARPETING
099123	INTERIOR PAINTING

DIVISION 10 – SPECIALTIES

102600 WALL AND DOOR PROTECTION

DIVISION 12 – FURNISHINGS

123661.16 SOLID SURFACE COUNTERTOPS

DIVISION 20 – MECHANICAL GENERAL REQUIREMENTS

200000 MECHANICAL GENERAL REQUIRMENTS
200529 MECHANICAL HANGERS AND SUPPORTS
200548 VIBRATION AND SEISMIC CONTROL
200553 MECHANICAL IDENTIFICATION
200700 MECHANICAL INSULATION

DIVISION 22 – PLUMBING

221100 DOMESTIC WATER PIPING AND SPECIALTIES
221300 SANITARY WASTE AND VENT PIPING SPECIALTIES
224000 PLUMBING FIXTURES

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

230131 DUCT CLEANING
230593 TESTING, ADJUSTING AND BALANCING
232113 HYDRONIC PIPING AND SPECIALTIES
233100 DUCTS AND ACCESSORIES
233600 AIR TERMINAL UNITS
233700 AIR OUTLETS AND INLETS

DIVISION 25 –INTEGRATED AUTOMATION

255000 BUILDING AUTOMATION SYSTEM
259000 SEQUENCE OF OPERATIONS

DIVISION 26 – ELECTRICAL

260000 ELECTRICAL GENERAL REQUIREMENTS
260519 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
260943	NETWORK LIGHTING CONTROLS
262726	WIRING DEVICES
265000	LIGHTING FIXTURES

DIVISION 27 – COMMUNICATIONS

272010	TELECOM DISTRIBUTION SYSTEM
--------	-----------------------------

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

283100	ADRESSABLE FIRE ALARM SYSTEM
--------	------------------------------

END OF TABLE OF CONTENTS

**SECTION 01 11 00
SUMMARY OF WORK**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Work Summary

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work Summary:
Contractors will review existing conditions and prepare a bid for the **Insert Name Here** Project based on the information contained in this Project Manual and the Drawings dated **xx/xx/xxxx** and Specifications dated **xx/xx/xxxx**. Additionally, the contractor shall comply with all administrative requirements of the contract, including the submission of a Contractor's Construction Schedule, safety plan, Schedule of Values, daily reports, Submittals, and other deliverables required under the contract.

3.02 METHOD

- A. Construct the Work under a Guaranteed Maximum Price contract.

3.03 WORK BY OWNER

- A. Not Applicable

3.04 CONTRACTOR'S USE OF PREMISES

- A. **The Southcentral Foundation Campus and the **Insert Name Here of Facility** is a Tobacco Free campus. No smoking is permitted on the campus or in any Areas of Work.**
- B. The Contractor will coordinate with SCF for area of use.
- C. Limit use of premises for the Work and for storage to allow for:
 - 1. Owner occupancy.
 - 2. Public use.

3. Coordinated use of premises under direction of Owner.
 4. Full responsibility for protection and safekeeping of products under this Contract stored at Project Site.
 5. Moving any stored products, under Contractor's control, which interfere with operations of Owner or separate Contractor(s).
- D. Obtain and pay for use of any additional storage or work areas needed for operations.

3.05 OWNER'S OCCUPANCY

- A. The Owner will continue to occupy and operate the **Insert Name Here of Facility**. The Contractor shall coordinate with the Owner to allow normal operations to continue.
- B. Contractor shall schedule and coordinate with the **Insert Name Here of Facility**, any work which could interfere with the Owner operations.
- C. Cooperate with the Owner in construction operations to minimize conflict and to facilitate Owner usage.
- D. After substantial completion, schedule work to maintain Owner's operation. Include in contract sum sufficient funds as may be required for any "after hours" work caused by this requirement. No additional payment to Contractor will be authorized because of Contractor's failure to anticipate required "after hours work".
- E. Contractor shall conduct operations to insure the least inconvenience to staff, visitors, and the public.

3.06 EXCESSIVE NOISE

- A. Minimize noise during Owner's normal working hours. Notify Owner at least 72 hours prior to noisy operations.

3.07 USE OF OWNER'S PROPERTY AND EQUIPMENT

- A. Use of Owner's property or equipment such as tools, ladders, furniture, janitorial equipment and supplies etc., is strictly prohibited.

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 01 11 00 - Summary of Work
- C. Section 01 26 00 - Contract Modification Procedures
- D. Section 01 30 00 – Administrative Requirements
- E. Section 01 60 00 - Product Requirements
- F. Section 01 70 00 – Execution and Closeout Requirements
- G. Section 01 70 00 – Closeout Submittals

1.02 SCHEDULE OF VALUES

- A. Coordinate with Contractor's construction schedule and Application for Payment.
- B. Submit typed Schedule of Values using form AIA G703-1992 for Bid-Build projects, AIA G743 for Design-Build projects, or alternate form pre-approved by Owner.
- C. Submit Schedule of Values to the Architect, Owner, and Owner's Representative as soon as possible, but no later than 20 days after Notice to Proceed for Construction has been issued.
- D. Format: When using a pre-approved, non-AIA G702-1992 form for a Schedule of Values, the format shall be as follows: Utilize the Table of Contents of this Project Manual and include other significant work items. At a minimum, rough-in and finish work shall be broken out separately.
 - 1. Identify each line item with number and title of the Specification Section. Identify site mobilization, bonds, and insurance.
 - 2. Tabular form indicating:
 - a. Related Specification Section or Division.
 - b. Description of Work.

- c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
 4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
 5. Provide a separate line item in the Schedule of Values for each part of the Work where an Application for Payment may include materials or equipment, purchased, or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
 6. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.
 7. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- E. Include within each line item, a directly proportional amount of Contractor's overhead and profit.
- F. Provide sub schedule for each separate stage of work specified in Section 01 11 00 - Summary of Work.
- G. Revise schedule to list approved Change Orders, with each Application for Payment.

1.03 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect (or Owner on Design-Build Projects) and paid for by the Owner.
 - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

- B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the General Conditions.

- C. Payment Application Form: Use AIA Document G702-1995 and Continuation Sheets G703-1992 or alternative form pre-approved by Owner.

- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect (or Owner if project is Design-Build) will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

- E. Transmittal: Submit 1 completed, signed, and notarized copy of each Application for Payment to the Architect (or Owner if a Design-Build Project) by a method pre-approved by the Owner, including waivers of lien and similar attachments, when required by contract.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect and Owner.

- F. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
 - 1. List of subcontractors.
 - 2. List of principal suppliers and fabricators.
 - 3. Approved Schedule of Values.
 - 4. Contractor's Construction Schedule (preliminary if not final).
 - 5. Submittal Schedule (preliminary if not final).
 - 6. Certificates of insurance and insurance policies.

- G. Applications for Progress Payments
 - 1. Payment Period: Submit at intervals stipulated in Contract.

2. Electronic media printout including equivalent information will be considered in lieu of standard form specified: submit sample to Architect for approval.
 3. Submit Applications for Payment on an approved form per the Contract and this specification.
 4. For each item, provide a column for listing each of the following:
 - a. Item Number.
 - b. Description of work.
 - c. Scheduled Values.
 - d. Previous Applications.
 - e. Work in Place and Stored Materials under this application.
 - f. Authorized Change Orders.
 - g. Total Completed and Stored to Date of Application.
 - h. Percentage of Completion.
 - i. Balance to Finish.
 - j. Retainage, if applicable (see contract).
 5. Execute certification by signature of authorized officer and notarize payment applications.
 6. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
 7. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
 8. Submit Application for Payment utilizing Owner's project information management software, or in a manner agreed upon by Owner.
 9. Include the following with the application:
 - a. Construction Progress Schedule; revised and current as specified in Section 01 32 00 Construction Progress Documentation.
 10. When Architect or Owner requires substantiating information, submit data justifying dollar amounts in question. Provide data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 2. Administrative actions and submittals that shall precede or coincide with this application include those required for Substantial Completion as outlined in Section 01 70 00 Execution and Closeout Requirements.
- I. Final Payment Application: Administrative actions and submittals that

must precede or coincide with submittal of the final Application for Payment including Section 01 70 00 - Execution and Closeout Requirements and Section 01 78 00 – Closeout Submittals.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Document 005213 – Agreement Form
- C. Document 002113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. ____ - _____:
 - 1. Base Bid Item: Section _____ and Drawing number ____ including _____.
 - 2. Alternate Item: Section _____ and Drawing number ____ including _____.
- B. Alternate No. ____ - _____:
 - 1. Base Bid Item: Section _____ and Drawing number ____ including _____.
 - 2. Alternate Item: Section _____ and Drawing number ____ including _____.
- C. Alternate No. ____ - _____:
 - 1. Base Bid Item: Section _____ and Drawing number ____ including _____.
 - 2. Alternate Item: Section _____ and Drawing number ____ including _____.
- D. Alternate No. ____ - _____:

1. Base Bid Item: Section _____ and Drawing number ____ including _____.
2. Alternate Item: Section _____ and Drawing number ____ including _____.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 002113 - Instructions to Bidders: Restrictions on timing of substitution requests.
- C. Section 012300 - Alternates, for product alternatives affecting this section.
- D. Section 013000 - Administrative Requirements: Submittal procedures, coordination.
- E. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.
- B. Substitutions: See General Conditions for definition.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 2. Agrees to provide the same warranty for the substitution as for the specified product.
 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Documentation: Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on Contractor.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Request date.
 - 4) Reference to particular Contract Document(s) specification section number, title, article/paragraph(s), and/or sheet number, drawing number, drawing title, etc.
 - 5) Description of Substitution.
 - 6) Reason why the specified item cannot be provided.
 - 7) Differences between proposed substitution and specified item.
 - 8) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Sustainable design features.

- 6) Warranties.
- 7) Other salient features and requirements.
- 8) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
 - 1) Savings (or additional cost) to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.

- D. Quantity/ Limitation: Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document, to the Architect and Owner.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- E. Submittal Time Restrictions:
 - 1. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- F. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to the time required for review and approval by Architect, in order to stay on approved project schedule.
- G. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect and Owner, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- H. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.

3.04 RESOLUTION

- I. Architect or Owner may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- J. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

- K. Accepted substitutions change the Work of the Project. They will be documented and incorporated into Work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- L. See Section 017800 - Closeout Submittals, for closeout submittals requirements.
- M. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected requests.

END OF SECTION

**SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES**

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Procedures for documenting and processing contract modifications.

1.02 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 00 52 13 – Agreement Form.
- C. Section 01 20 00 – Price and Payment Procedures.
- D. Section 01 60 00 - Product Requirements.
- E. Section 01 70 00 – Execution and Closeout Requirements.

1.03 SUBMITTALS

- A. Submit name of the individual authorized to receive change documents and be responsible for informing others in contractor's employ or subcontractors of changes to the Work.
- B. Proposal Form (for proposed change): AIA Document G709-2018 or another form acceptable to Owner.
- C. Change Order Form: AIA Form G701-2017 - Change Order or other form acceptable to Owner.

1.04 DOCUMENTATION OF CHANGE IN CONTRACT SUM AND CONTRACT TIME

- A. Maintain detailed records of work done on a time and materials basis. Provide full information required for evaluation of proposed changes, and to substantiate costs of changes in the Work.
- B. Document each quotation for a change in cost or time with sufficient data to allow evaluation of the quotation.
- C. On request, provide additional data to support computations:
 - 1. Quantities of products, labor, and equipment.
 - 2. Taxes, insurance and bonds.
 - 3. Overhead and profit.

4. Justification for any change in Contract Time.
 5. Credit for deletions from Contract, similarly documented.
- D. Support each claim for additional costs and for work done on a time and materials basis, with additional information:
1. Origin and date of claim.
 2. Dates and times work was performed, and by whom.
 3. Time records and wage rates paid.
 4. Invoices and receipts for products, equipment and subcontracts, similarly documented.

1.05 CHANGE PROCEDURES

- A. Architects Supplemental Instructions: The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time, by issuing supplemental instructions on AIA Form G710-2017 - Architect's Supplemental Instructions.
- B. Proposal Request: The Owner may issue a Proposal Request (AIA Document G709 or form acceptable to Owner) which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid.
- C. Change Proposal: The Contractor may propose a change by submitting a request for change to the Owner, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 016000 – Product Requirements.
- D. It is the Owners decision whether a change directive is stipulated sum, unit price, or time and materials.

1.06 CONSTRUCTION CHANGE AUTHORIZATION

- A. Architect or Owner may issue a document, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The document will describe changes in the Work and will designate the method of determining any change in Contract Sum or Contract Time.
 2. Promptly execute the change in Work.

1.07 STIPULATED SUM CHANGE ORDER

- A. Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by the Owner.

1.08 TIME AND MATERIAL CHANGE ORDER

- A. Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- B. Maintain detailed records of work done on time and materials.
- C. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

1.09 EXECUTION OF CHANGE ORDERS

- A. Architect or Owner's Representative may prepare Change Orders for signatures of Owner, Contractor, and Architect as provided in the Conditions of the Contract, Article 7.

1.10 CORRELATION OF CONTRACTOR SUBMITTALS

- A. Promptly revise Schedule of Values and Application for Payment Forms to record each authorization Change Order as a separate line item and adjust the Contract Sum.
- B. Promptly revise Construction Progress Schedules to reflect any change in Contract Time, revise sub-schedules to adjust time for other items of work affected by the change, and resubmit.
- C. Promptly enter changes in Project Record Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Accident Prevention Plan.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Progress photographs.
- G. Submittals for review, information, and project closeout.
- H. Number of copies of submittals.
- I. Requests for Information (RFI) procedures.
- J. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 005213 – Agreement Form.
- C. Section 016000 - Product Requirements.
- D. Section 017000 - Execution and Closeout Requirements.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information 2004.
- B. AIA G810 - Transmittal Letter 2001.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Utilize SCF's Autodesk Construction Cloud (ACC) project management site for tracking and memorialization of all meeting agendas/minutes, submittals, RFI's ASI's, posting of drawings/specifications, document filing, and for all other project document tracking, as directed by the Owner.

- C. Make the following types of submittals to Architect:
1. Requests for Interpretation (RFI).
 2. Requests for substitution.
 3. Shop drawings, product data, and samples.
 4. Test and inspection reports.
 5. Design data.
 6. Manufacturer's instructions and field reports.
 7. Applications for payment and change order requests.
 8. Progress schedules.
 9. Coordination drawings.
 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 11. Closeout submittals.

1.05 ACCIDENT PREVENTION PLAN

A. Plan Overview

1. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Prime Contractor is considered to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

B. Plan Content

1. Include and address in the APP the following, at a minimum.
 - a. Type of Project/ Project Description
 - b. Scope of Work
 - c. Contact Information
 - d. Identification of person(s) responsible for safety at the project location and lines of authority
 - e. Project Location
 - f. Geographic Risks
 - g. Site drawings and hazard locations: Contractor's site safety plan, including mustering point, location of nearest hospital/ emergency clinic, vehicular and pedestrian traffic flow graphics, site security checkpoints, area of work limits/fencing, etc., at a minimum.
 - h. Procedures to avoid hazards (in the form of Activity Hazard Analysis and Work Plan, as needed, for each unique task where hazards exist).
 - 1) Crane work, confined space entry, scaffolding, walking and working surfaces including fall protection, and other specialized

work shall require a separate and specific Work Plan to address the unique risks and hazards associated with the work.

- i. Security risks and securing of supplies and the worksite.
 - j. Safety check schedule
 - k. Safety orientation for new workers and visitors to the site and accident notification process to Owner.
 - l. Accident notification and investigation process
 - m. PPE Guidelines
 - n. Safety Training
 - o. First Aid Locations
 - p. Hazard communication plan
 - q. All content required by OSHA and AHJs
 - r. Signature sheet signed by an Officer of the company and the Responsible Person onsite
- C. Plan Approval
- 1. Submit APP for Owner's approval a minimum of 3 weeks prior to any work being performed.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
 - 4. Owner's Representative (if applicable).
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contractor, Owner, Architect, and Owner's Representative (if applicable).
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, change orders, and contract closeout procedures.
 - 8. Scheduling.

- D. Record minutes and distribute copies electronically to Architect, Owner, Owner's Representative (if applicable), participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with electronic copies for participants (to be distributed 24 hours prior to meeting), preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Special consultants.
 - 5. Contractor's superintendent.
 - 6. Major subcontractors.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Review of RFIs log and status of responses.
 - 7. Maintenance of progress schedule.
 - 8. Corrective measures to regain projected schedules.
 - 9. Planned progress during succeeding work period.
 - 10. Coordination of projected progress.
 - 11. Maintenance of quality and work standards.
 - 12. Effect of proposed changes on progress schedule and coordination.
 - 13. Other business relating to work.
- E. Record minutes and distribute electronic copies within two days after meeting to Architect, Owner, and participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated construction schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide high quality digital photographs of site and construction throughout progress of work, using the ACC photo application.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
 1. Excavations in progress.
 2. Foundations in progress and upon completion.
 3. Structural framing in progress and upon completion.
 4. Enclosure of building, upon completion.

3.05 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716-2004 - Request for Information.

3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 016000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example, routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt, excluding SCF recognized holidays. For the purpose of establishing the start of the mandated response period, RFIs received after 2:00PM (Owner's local time) will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days, excluding SCF recognized holidays, if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.06 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Format schedule to allow tracking of status of submittals throughout duration of construction.
 2. Account for time required for preparation, review, manufacturing, fabrication, and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.07 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017000 – Execution and Closeout Requirements.

3.08 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use Form AIA G810-2001.
 - 4. Identify each item based on applicable specification section. For revised submittals use original number and a sequential numerical suffix.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - 7. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 14 calendar days, excluding SCF recognized holidays.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendar days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 calendar days.
 - 8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 9. Provide space for Contractor and Architect review stamps.
 - 10. When revised for resubmission, identify all changes made since previous submission.
 - 11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

12. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work and have received prior approval for their use.
 13. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as a single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - b. "Rejected".
- E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

**SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION**

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 00 52 13 – Agreement Form
- C. Section 01 30 00 – Administrative Requirements
- D. Section 01 70 00 – Execution and Closeout Requirements

1.02 DEFINITIONS

- A. Request for Information (RFI): Request from Owner, Architect, or Contractor seeking information required by a clarification of the Contract Documents.
- B. Architect's Supplemental Instructions (ASI): Information provided by Architect to clarify scope of work in Contract Documents.

1.03 PROJECT SCHEDULE

- A. Provide a project schedule for approval by the Architect and Owner prior to starting work. The Project Schedule shall use the Critical Path Method "CPM" or other Owner approved method. The Schedule shall have adequate detail that provides information on the planned work and tasks and shall be relationship driven using either predecessor or successor relationships. The schedule shall be updated and submitted with every Application for Payment, and uploaded to Autodesk Construction Cloud (ACC).

1.04 COORDINATION

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

3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Startup and adjustment of systems.
 8. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.05 COORDINATION DRAWINGS

- A. General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

- b. Coordinate the addition of trade-specific information to the coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
- c. Indicate functional and spatial relationships of components.
- d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- f. Indicate required installation sequences.
- g. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.06 KEY PERSONNEL

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, on Project Website, and by each temporary telephone. Keep list current at all times.

1.07 PROJECT MEETINGS

- A. General: Contractor will schedule and conduct meetings and conferences at Project site, unless otherwise indicated. Meeting agendas and notes shall utilize Autodesk Construction Cloud (ACC) software.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and

Architect, within two days of the meeting.

- B. Preconstruction Conference: Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 20 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs and ASIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Sustainable design requirements.
 - m. Preparation of record documents.
 - n. Use of the premises [and existing building if applicable].
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. Progress cleaning.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs and ASIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress and Coordination Meetings: Contractor will conduct progress meetings at appropriate intervals.

1. Coordinate dates of meetings with preparation of payment

- requests.
2. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals and RFI's
 - 4) Off-site fabrication and deliveries.
 - 5) Site access and utilization.
 - 6) Temporary facilities and controls.
 - 7) Progress cleaning.
 - 8) Quality and work standards.
 - 9) Status of correction of deficient items.
 - 10) Field observations.
 - 11) Status of proposal requests.
 - 12) Pending changes.
 - 13) Status of Change Orders.
 - 14) Pending claims and disputes.
 - 15) Documentation of information for payment requests.
 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Project coordination meetings are to be held weekly. Project coordination

meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 013000 - Administrative Requirements: Submittal procedures.
- C. Section 014200 - Reference Standards and Definitions.
- D. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. Note: If a newer version of any reference standard exists, the newer version shall be incorporated and followed in lieu of the older version referenced herein.
- B. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2023).
- C. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- D. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022a.
- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.

- F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- G. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- H. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.
- I. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

1.04 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly submit one electronic copy of report to Architect, Owner, and Owner's Representative.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, as specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit electronic instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner/ Owner's Representative.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.06 QUALITY ASSURANCE

- A. Contractor's Quality Control (CQC) Plan:
1. Thirty days prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- B. Quality-Control Personnel Qualifications. Engage a qualified person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project. QC personnel may be subject to SCF approval.

1.07 REFERENCES AND STANDARDS

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

- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to inspect against and to determine the acceptability of Work yet to be completed.
- C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- E. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- F. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect. Confirm with Architect and Owner prior to removal of mock-up.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment, as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

**SECTION 01 40 10
CLEAN CONSTRUCTION PROCEDURES**

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Clean Construction procedures, policies, and best practices and requirements.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.

1.03 PURPOSE

- A. To outline the process for selecting and implementing proper controls to reduce risk and to minimize impact of construction or renovation activities throughout Southcentral Foundation (SCF) facilities.

1.04 SCOPE

- A. This applies to all direct hire employees, Civil Service and Commissioned Corps Officers working under contractual agreements with Southcentral Foundation (SCF) and volunteers. Individuals and business entities that have entered into contractual agreements with Southcentral Foundation (SCF) are not exempt, unless otherwise stated in their contracts.

1.05 DEFINITIONS

- A. Customer-owner: Individuals who seek and receive services at SCF's programs and departments. The following terms may be used by SCF programs and departments in referring to customers:
 - 1. Patients
 - 2. Residents
 - 3. Students
 - 4. Members
 - 5. Beneficiaries
 - 6. Guests
 - 7. Event Participants
 - 8. Clients
- B. Infection Control Risk Assessment (ICRA) – A risk assessment tool that incorporates the facility's customer-owner population and type of construction work to reduce the risk of infection through phases of facility planning, design, construction, renovation, and maintenance.

1.06 PROCEDURE

- A. The Clean Construction Procedure with the accompanying Infection Control Risk Assessment (ICRA) Construction Permit will apply to all projects, including small construction and maintenance work.
- B. The ICRA will be implemented in the planning phase of each project and will be assessed by the Manager of Facilities or designee, in consultation with the Project Manager, Safety Manager and Quality Assurance (QA) Nurse Manager or designee.
- C. The Manager of Facilities or designee will provide updated documentation of the risk assessment throughout planning, design, and construction.
- D. Performance Standards
 - 1. ICRA will be initiated and maintained by the Manager of Facilities or designee, in consultation with the QA Nurse Manager or designee, and Safety Manager at all appropriate construction sites and areas with Infection Control (IC) deficiencies.
 - 2. Selected ICRA will be monitored by the Manager of Facilities in consultation with the QA Nurse Manager or designee, Safety Manager and Security Officers on weekends and holidays.
 - 3. The Manager of Facilities or designee, will provide briefings to the affected employees, including construction workers, to inform the staff of the particular ICRA for areas where they work.
- E. Manager of Facilities Responsibilities:
 - 1. The Manager of Facilities in consultation with the QA Nurse Manager or designee and the Safety Manager will select and implement appropriate infection control measures/actions for existing hazards that violate infection control standards and/or guidelines.
 - 2. The Manager of Facilities or designee will ensure the ICRA measures/actions are maintained and enforced.
 - a. The Manager of Facilities or designee will consult with the QA Nurse Manager or designee and the Safety Manager for all Type C and Type D projects as defined in this procedure.
 - 3. The Manager of Facilities or designee will ensure that ICRA measures/actions are incorporated into all contractor negotiations and contracts.
 - 4. The Manager of Facilities or designee will ensure that contractors and maintenance employees adhere to the implemented ICRA measures/actions.
 - 5. Contractors are responsible for training their employees and enforcing ICRA measures/actions with their employees.
 - 6. Employees are responsible for adhering to established ICRA measures/actions and for reporting any violations of this procedure to the Manager of Facilities or designee.

F. Project Assessment

1. Each project will be assessed for risk during the planning phase by Facilities.
 - a. The project will be assigned a risk group to include employees from Corporate QA, Facilities, and the affected program and will be matched with a project type that will determine a class of precautions to be implemented.
2. The class of precautions will be determined by using the Type of Work Matrix described in this procedure.
3. Type of Projects (Work)
 - a. Type A (Minor) - Inspection and non-invasive projects including, but not limited to:
 - a) Removal of ceiling tiles for visual inspection
 - b) Painting with no sanding
 - c) Wall covering
 - d) Electrical trim work
 - e) Minor plumbing and
 - f) Other activities that do not generate dust
 - b. Type B (Maintenance) – Short duration / minimal dust projects which include, but are not limited to:
 - a) Setting brackets
 - b) Hanging items
 - c) Cutting of walls or ceilings where dust migration can be controlled to the immediate work area and the duration is less than one (1) work shift
 - d) Cutting of walls or ceilings where dust migration can be controlled, and the duration is less than one (1) work shift
 - c. Type C (Moderate) – Short duration / minor dust projects, including, but is not limited to:
 - a) Sanding
 - b) Removal of floor coverings, ceiling tiles, and casework
 - c) New wall construction
 - d) Minor duct work or electrical work above the ceiling
 - e) Major cabling activities
 - d. Type D (Major) – Projects that generate dust or require demolition of fixed building components which include, but are not limited to:
 - a) Activities which require consecutive work shifts
 - b) Require heavy demolition and/or removal of a complete cabling system
 - c) New construction
4. Type of Area
 - a. Low Risk:

- a) Plant area and other areas not intended for customer-owner use
 - b) Warehouse
 - c) Office areas
- b. Medium Risk:
- a) Physical Therapy
 - b) Radiology
 - c) Outpatient Clinics (not including office areas)
 - d) Dental Clinics
 - e) Pharmacy
 - f) Employee Family Center
 - g) Living quarters at residential treatment programs
 - h) Food service or kitchen areas
- c. High Risk:
- a) Endoscopy
 - b) Laboratory
- d. Highest Risk
- a) Dental Sterile Processing

5. Risk Group Classifications

Risk Group Classification	Type A	Type B	Type C	Type D
Low Risk	I	I/II	II	III/IV
Medium Risk	I	I/II	III	IV
High Risk	I	I/II	III/IV	IV
Highest Risk	I/II	III/IV	III/IV	IV

Note: Infection Control approval will be required when the construction activity and risk level indicate that **Class III** or **Class IV** control procedures are necessary.

6. Infection control measure based on class:

	During Construction Project	Upon Completion of Project
Class I	<ol style="list-style-type: none"> 1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace any ceiling tile displaced for visual inspection. 	<ol style="list-style-type: none"> 1. Clean work area upon completion of work.

Class II	<ol style="list-style-type: none"> 1. Provide active means to prevent air-borne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with tape. 4. Block off and seal air vents. 5. Remove or isolate heating, ventilation, and air conditioning (HVAC) system in areas where work is being performed. 	<ol style="list-style-type: none"> 2. Wipe work surfaces with disinfectant. 3. Contain construction waste before transport in tightly covered containers. 4. Wet mop and/or vacuum with High-Efficiency Particulate Air (HEPA) filtered vacuum before leaving work area. 5. Remove isolation of HVAC system in areas where work is being performed.
Class III	<ol style="list-style-type: none"> 1. Remove or isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within the work site utilizing HEPA equipped air filtration units. 4. Contain construction waste before transport in tightly covered containers. 5. Cover transport receptacles or carts. Tape covering unless solid lid. 	<ol style="list-style-type: none"> 1. Do not remove barriers from work area until completed project is inspected by the Manager of Facilities, Safety Manger and QA Nurse Manager or designee, and is thoroughly cleaned by housekeeping. 2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with disinfectant. 5. Remove isolation of HVAC system in areas where work is being performed.

Class IV	<ol style="list-style-type: none"> 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures appropriately. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from the work area until completed project is inspected by owner's Safety Department and Infection Control Department and thoroughly cleaned by owner's Environmental Services Department. 	<ol style="list-style-type: none"> 1. Do not remove barriers from work area until completed project is inspected by the Manager of Facilities, Safety Manager and QA Nurse Manager or designee, and is thoroughly cleaned by Environmental Services Department. 2. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction. 3. Contain construction waste before transport in tightly covered containers. 4. Cover transport receptacles or carts. Tape covering unless solid lid. 5. Vacuum work area with HEPA filtered vacuums. 6. Wet mop area with disinfectant. 7. Remove isolation of HVAC system in areas where work is being performed.
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7. Environmental monitoring:
 - a. The Manager of Facilities will conduct field inspections at any time during the life of the project with the assistance of the QA Nurse Manager or designee and Safety Manager.
 - b. The Manager of Facilities will monitor air quality throughout project as needed.

8. Implementation of Infection Control Measures
 - a) Temporary construction barriers and closures will be dust-tight.
 - b) Removal of debris will be in tightly covered containers.
 - c) Adhesive walk-off mats will be placed at all entrances to work site, as needed.
 - d) Any dust tracked outside of the barrier will be removed immediately.

- e) Any ceiling access panels opened for investigation beyond sealed areas will be replaced immediately when unattended.
 - f) Block off all ventilation and return ducts within the construction area.
 - g) Method of capping ducts will be dust tight and airflow to those devices will be shut off (either with the direct digital control (DDC) and/or damper).
 - h) Removal of construction barriers and ceiling protection will be done carefully.
 - i) Vacuum and clean all surfaces free of dust after the removal.
 - j) Housekeeping will be notified to do a follow up cleaning of the area.
 - k) When access panels are opened in occupied areas requiring protection, for work above ceilings, use a polyethylene enclosure around ladder, sealing off opening.
 - l) The device will be fitted/sealed tightly to the ceiling and floor per manufacturers' instructions.
9. Enforcement of Infection Control Measures
- a. The Manager of Facilities, QA Nurse Manager or designee, or Safety Manager may stop the work if this procedure is violated.
 - a) Work will not resume until all violations of this procedure are corrected and verified in writing.
 - b. The Manager of Facilities will record the following:
 - a) Document each violation with photographs and written reports
 - b) Extract contractor or department information from the work log
 - c) Maintain a record of all infection control violations
 - c. Violations of this procedure may affect status as a responsible contractor for bidding future work.

1.07 REFERENCES

- A. Attachment A – Specification Section 01 40 10.01 – Infection Control Risk Assessment Construction Permit.
- B. Facility Guidelines Institute, Guidelines for Design and Construction of Healthcare Facilities (2022).

END OF SECTION

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

*This form is an evaluation tool and **NOT** intended to replace required project, compliance, or safety documentation.*

Instructions: Please complete the entire form and submit to the Project Manager, SCF Facilities, and SCF Safety for review and approval. ILSM, ICRA, and IUSM approvals may require multiple steps and can take more than a week to approve, so plan accordingly. To expedite, consider attaching supporting documentation. Risk assessment should identify specific mitigation methods for each phase of the project. Utilize the clarification section to identify the applicability of additional forms (i.e. Demo higher ICRA need than finishing work)

Once approved and signed; display and hang a copy at the work site to be available upon request.

Section 1: General Project Information – <i>required section</i> –		Anticipated project date range:		Today's Date:		
Submitted By (name & company)		Start Date:		Estimated End Date:		
Project Manager (name & contact #):		Impacted Department(s) (list all that apply):				
Contractor Contact (name & contact #):		Impacted Department(s) Contact #:				
Appointed Site Safety Officer (name & contact #)		Adjacent Department(s) (list all that apply):				
Life Safety Occupancy (business, hospital, etc.):	Business	Anticipated Accreditation or Regulatory Surveys:				

Important Contacts:	SCF Security: 907.729.5700	SCF Safety: 907.575.8006	Infection Control: 907.570.6475

Construction Project Type Assessment – Circle Class					
Risk Each project is assessed by assigning a risk group and project type to determine infection prevention precautions required during project. Clean Construction Procedure #805-03 Infection Control Permit and Class Procedures provided below, PM signature required.	Activity				
		Type A	Type B	Type C	Type D
	LOW RISK	Class I	Class II	Class II	Class III/IV
	MEDIUM RISK	Class I	Class II	Class III	Class IV
	HIGH RISK	Class I	Class II	Class III/IV	Class IV
HIGHEST RISK	Class II	Class III/IV	Class III/IV	Class IV	

Type A	Type B	Type C	Type D
Inspection and noninvasive activities such as: <ul style="list-style-type: none"> Removal of ceiling tiles for visual inspection only, limited to one tile per 50 square feet Painting (without sanding) Wall covering replacement Electrical trim work Minor plumbing Activities without dust 	Small-scale, short-duration activities that create minimal dust: <ul style="list-style-type: none"> Includes, but is not limited to: Setting brackets Hanging items Cutting of walls or ceiling where dust migration can be controlled to the immediate work area and the duration is less than one shift 	Work that generates moderate to high level of dust or requires demolition, or removal of any fixed building components or assemblies: <ul style="list-style-type: none"> Removal of floor/wall coverings, ceiling tiles, or casework Cutting walls or ceilings where dust migration can be controlled and the duration is less than one work shift Minor duct work or electrical work above ceilings Major or invasive cabling activities New wall construction 	Major demolition and construction projects: <ul style="list-style-type: none"> Removal of floor/wall coverings, ceiling tiles, and casework Cutting of walls or ceilings where dust migration can be controlled and the duration is less than one shift Minor duct work or electrical work above ceilings Major or invasive cabling activities New wall construction
Low Risk Areas	Medium Risk Areas	High Risk Areas	Highest Risk Areas
<ul style="list-style-type: none"> Plant areas Supply areas Office areas not near patient care Areas not intended for patient use 	<ul style="list-style-type: none"> Outpatient clinics (<i>not specified in high or highest risk category</i>) Cardiology Dental Echocardiography Physical Therapy Radiology/MRI Respiratory Therapy Outpatient Pharmacy 	<ul style="list-style-type: none"> Emergency Room/Fast Track Laboratory Maternal Child (Labor & Delivery) Newborn Nursery Outpatient Surgery (Day Surgery) Inpatient Pharmacy (non-compounding) Corridors in high risk areas 	<ul style="list-style-type: none"> Operating rooms; including C-Section Central Supply/Sterile Processing Department Intensive Care Units Endoscopy Negative Pressure Isolation Rooms Oncology Areas immune-compromised patients.

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Infection Prevention & Control Requirements				Identified Risk or Hazard	Req'd	Additional info.
Evaluation Required – accredited campus	YES	NO	N/A	Completed Infection Control Risk Assessment (ICRA) – IC signature required for Class III & IV projects	ICRA/Class	Coordinate w/ Infection Control (IC)
	YES	NO	N/A	Airborne infection isolation room(s) impacted	ICRA	Coordinate with IC and department
	YES	NO	N/A	Temporary dust-tight construction barriers	ICRA	Coordinate with IC and department
	YES	NO	N/A	Construction waste transport and disposal	ICRA	Walk-off mats, covered carts, etc.
	YES	NO	N/A	Domestic water system be impacted	ICRA	Reference ANMC procedure #801-07
	YES	NO	N/A	Potential worker exposure to infectious diseases	ICRA	Coordinate with IC and department
	YES	NO	N/A	Immune-compromised patients in area or nearby	ICRA	Coordinate with IC and department

Life Safety Requirements				Identified Risk or Hazard	Req'd	Additional info.
Select YES if any of the risks or hazards apply and proceed with requirements.						
Evaluation Required – accredited campus	YES	NO	N/A	Completed assessment for Interim Life Safety Measures (ILSM) – ILSM form, signatures required	ILSM	Complete ILSM assessment with required signatures.
	YES	NO	N/A	Fire alarm or sprinkler system impaired (e.g. out of service, disabled smoke detector(s) or sprinkler(s))	ILSM	Evaluate for Fire Watch and complete form as needed
	YES	NO	N/A	Alternate egress required - block or obstruct exits (exit signs, >6" corridor projections, evacuation plans)	ILSM	Review Life Safety Plans, post fire safety response plan for contractor and employees; document education
	YES	NO	N/A	Temporary smoke-tight construction partitions (e.g. occupied spaces)	ILSM	
	YES	NO	N/A	Fire or smoke barrier penetration (e.g. missing ceiling tiles, doors, walls)	ILSM	Evaluate for Fire Watch and complete form as needed
	YES	NO	N/A	Above ceiling work (i.e. penetrations, cabling, debris, broken tiles)	ILSM	Evaluate for ILSM
	YES	NO	N/A	Storage of supplies and waste required (e.g. flammable or combustible materials, debris, dust, waste)	ILSM	Evaluate for ILSM
	YES	NO	N/A	Hot work including fire or spark producing (e.g. welding, grinding metal, soldering)	ILSM	Complete hot work permit, post copy at site where work is taking place
	YES	NO	N/A	Evaluate for Fire Watch needs for project	ILSM	Evaluate for ILSM
				Structural fire proofing		Evaluate for ILSM

Utility Systems Requirements				Identified Risk or Hazard	Req'd	Additional info.
Select YES if any of the risks or hazards apply and proceed with requirements.						
Evaluation Required – accredited campus	YES	NO	N/A	Electricity interruptions	IUSM	Evaluate for interim utility measures (IUSM) & required coordination.
	YES	NO	N/A	Water interruptions	IUSM	Evaluate for IUSM and develop water damage prevention plan.
	YES	NO	N/A	Heating Ventilation Air Conditioning interruptions	IUSM	Evaluate for IUSM & coordination
	YES	NO	N/A	Medical gas	IUSM	Evaluate for IUSM & coordination
	YES	NO	N/A	Pneumatic Tube	IUSM	Evaluate for IUSM & coordination
	YES	NO	N/A	Suction	IUSM	Evaluate for IUSM & coordination
	YES	NO	N/A	Networking, data systems, or telecommunications	IUSM	Evaluate for IUSM & coordination
	YES	NO	N/A	Cabling – requiring pass through walls or ceilings	IUSM/ ILSM	Evaluate for IUSM & ILSM
	YES	NO	N/A	Other systems – nurse call, overhead paging,	IUSM	Evaluate for IUSM & coordination
				Potential worker exposure to infectious diseases	IUSM/ ICRA	Evaluate for IUSM & ICRA

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)
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Safety Requirements	Identified Risk or Hazard			Req'd	Additional info.	
	Select YES if any of the risks or hazards apply and proceed with requirements.					
Evaluation Required – ALL PROJECTS	YES	NO	N/A	Communication Plan (notification to construction team, impacted areas, and staff)		Post required signage and notify impacted staff
	YES	NO	N/A	Noise or vibration in area or nearby (special considerations required for NICU/Peds and inpatient areas)		Coordinate with impacted Department(s)
	YES	NO	N/A	Hazardous Materials & Waste (considerations for hazards and PPE - odors, fumes, VOC, corrosives)		Review Safety Data Sheet (SDS) & OSHA requirements, keep SDS on site
	YES	NO	N/A	Biohazardous Waste (considerations for disposal and proper PPE per OSHA 1910.1030)		Evaluate for compliance with OSHA 1910.1030 and ANMC Procedures
	YES	NO	N/A	Construction Site Safety (e.g. falling objects, tripping hazards, fall protection, PPE)		Appoint Site Safety Officer
	YES	NO	N/A	Motorized equipment (e.g. forklift, scissors lift, crane)		Evaluate for specific requirements including competency/training
	YES	NO	N/A	Relocate occupants (e.g. patients, staff, classes, meetings, etc.)		Coordinate with impacted Department(s)
	YES	NO	N/A	Confined Space entry required		Evaluate for confined space requirements per OSHA
	YES	NO	N/A	Scaffolding or working on elevated surfaces		Evaluate for fall protection requirements per OSHA

Security Requirements	Identified Risk or Hazard			Req'd	Additional info.	
	Select YES if any of the risks or hazards apply and proceed with requirements.					
Evaluation Required – accredited campus	YES	NO	N/A	Access Control (e.g. ID badge access, physical keys, disable security systems)		
	YES	NO	N/A	High Security Considerations (e.g. perimeter, medications, medical records, IT, HR files, etc.)		PM to coordinate with departments, Security, and Control Room
	YES	NO	N/A	Medication Safety and Security (i.e. unsecure doors/walls/ceilings, moving Pyxis, waste)		PM coordinate with Pharmacy/Dept.
	YES	NO	N/A	Other security measures (explain):		PM to coordinate with departments, Security, and Control Room
	YES	NO	N/A			

Additional Information or Requirements:	
PCRA Signatures	
Reviewed and signed by at least the Health Facilities, ANMC Safety, and Infection Control. At a minimum a copy of the signed form should be provided to the Department Director, Security, and affected areas and available at the worksite.	
Facilities/ Projects print name and signature:	Infection Control print name and signature:
Date:	Date:
	Signature of SCF Safety (as applicable):
	Date:

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

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Infection Control Constructions Permit – Project Requirements by Class as designated on the PCRA		
	During Project	Upon Completion of Project
Class I	<ul style="list-style-type: none"> Execute work by methods to minimize raising dust from construction operations Immediately replace a ceiling tile displaced for visual inspection 	<ul style="list-style-type: none"> Clean work area upon completion of task
Class II	<ul style="list-style-type: none"> Provide active means to prevent airborne dust from dispersing into the atmosphere Water mist work surfaces to control dust while cutting Seal unused doors with duct tape Block off and seal air vents Place dust mat at entrance and exit of work area Remove or isolate HVAC system in areas where work is being performed 	<ul style="list-style-type: none"> Wipe work surfaces with cleaner/disinfectant Contain construction waste before transport in tightly covered containers Wet mop and/or vacuum with high-efficiency particulate air (HEPA) filtered vacuum before leaving work area Upon completion, restore HVAC system where work was performed
Class III	<ul style="list-style-type: none"> Remove or isolate HVAC system in area where work is being done to prevent contamination of duct system Complete all critical barriers, e.g., sheetrock, plywood, plastic to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units Contain construction waste before transport in tightly covered containers Cover transport receptacles or carts. Tape covering unless lid is solid. 	<ul style="list-style-type: none"> Do not remove barriers from work area until completed project is inspected by the Infection Control or Safety Officer or representative and they are thoroughly cleaned by EVS staff. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. Vacuum work area with HEPA-filtered vacuums. Wet mop area with cleaner/disinfectant. Upon completion, restore HVAC system where work was performed.
Class IV	<ul style="list-style-type: none"> Isolate HVAC system in area where work is being done to prevent contamination of duct system. Complete all critical barriers, e.g. sheetrock, plywood, plastic to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Maintain negative air pressure within work site utilizing HEPA-equipped air filtration units Seal holes, pipes, conduits, and punctures. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or have them wear cloth or paper coveralls that are removed each time they leave work site. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 	<ul style="list-style-type: none"> Do not remove barriers from work area until completed project is inspected by the Infection Control or Safety Officer or representative and they are thoroughly cleaned by EVS staff. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. Contain construction waste before transport in tightly covered containers. Cover transport receptacles or carts. Tape covering unless solid. Vacuum work area with HEPA-filtered vacuums. Wet mop area with cleaner/disinfectant. Upon completion, restore HVAC system where work was performed.

Additional Information or Requirements (additional measures being taken to mitigate infection control measures):

Infection Control print name and signature:	Facilities/ Projects print name and signature:
Date:	Date:

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

*This form is an evaluation tool and **NOT** intended to replace required project, compliance, or safety documentation.*

Instructions: PM to ensure the below answers are provided for each ILSM. For any "YES" answers, indicate the duration of the measure and review the, the "Implemented ILSM" column details the minimum required ILSM. Unless otherwise noted, the PM is responsible to implement all required ILSMs. Blank rows are provided to allow additional ILSMs as required for the safety of patients and staff and the preservation of the facility. Include drawings to show the affected area and where specific ILSMs will be implemented. PM to obtain proper review and approvals prior to beginning work.					
Measure	ILSM Evaluation			Duration of ILSM dates/phase(s)	Implemented ILSM
1.	Will a fire alarm system be out of service for more than 4 hours in a 24-hour period?	YES	NO		Director of Facilities, or designee, will notify the fire department and other emergency response services. PM to initiate Fire Watch and document according to fire watch procedure and forms. To the extent possible the detectors will be disabled and covered during work hours but enabled during non-work hours as fully functional.
2.	Will the fire sprinkler system be out of service for more than 10 hours in a 24-hour period?	YES	NO		Director of Facilities, or designee, will notify the fire department and other emergency response services. PM to initiate Fire Watch and document according to fire watch procedure and forms.
3.	Will exit accesses, exits, or exit discharges be blocked?	YES	NO		Post signs identifying alternate exits for impacted personnel. Impacted personnel will follow procedures for ILSM evacuation and emergency response. Remaining means of egress shall be maintained at all times and inspected at least daily using the PCRA Inspection Checklist which will be kept in the project folder and at the work site.
4.	Will an exit access, exit, or exit discharge be obstructed?	YES	NO		Remaining means of egress shall be maintained at all times and inspected at least daily using the PCRA Inspection Checklist which will be kept in the onsite project folder. Considerations should include patient and support equipment movement
5.	Will fire alarm and detection systems be impaired in an unoccupied room?	YES	NO		Temporary fire alarm/detection systems shall be provided in the affected space and must be approved by the Director of Facilities or designee. Temporary systems will be tested and inspected monthly. Affected/nearby staff will be trained to recognize and respond to an alarm from the temporary fire system. Documentation kept with the onsite project folder.)
6.	Will hot work be required?	YES	NO		The Director of Facilities or designee will provide an additional portable fire extinguisher that will be kept in the construction area. Construction personnel will be provided training on the fire extinguishing equipment. Complete hot work permit. Initiate fire watch. Document according to fire watch procedure.
7.	Will the work area contain or be used to store excessive flammable material?	YES	NO		The Director of Facilities or designee will provide an additional portable fire extinguisher that will be kept in the area. Affected personnel will be provided training on the fire extinguishing equipment.
8.	Will the existing smoke compartment boundary, corridor construction, or other fire barriers be impaired/ degraded and the duration of the project be less than or equal to 5 calendar days?	YES	NO		Business Occupancy:
		YES	NO		Ambulatory Occupancy:
		YES	NO		Other Occupancy:

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

*This form is an evaluation tool and **NOT** intended to replace required project, compliance, or safety documentation.*

Instructions: PM to ensure the below answers are provided for each ILSM. For any "YES" answers, indicate the duration of the measure and review the, the "Implemented ILSM" column details the minimum required ILSM. Unless otherwise noted, the PM is responsible to implement all required ILSMs. Blank rows are provided to allow additional ILSMs as required for the safety of patients and staff and the preservation of the facility. **Include drawings to show the affected area and where specific ILSMs will be implemented.** PM to obtain proper review and approvals prior to beginning work.

Measure	ILSM Evaluation	Duration of ILSM dates/phase(s)	Implemented ILSM
9.	Will the existing smoke compartment boundary, corridor construction, or other fire barriers be impaired/degraded and the duration of the project be greater than 5 calendar days?	YES NO	
10.	Will the existing ceiling or wall smoke barriers be impaired/degraded?	YES NO	
11.	Will construction activity include excavations, hazardous storage areas, or site conditions that have potential to significantly impact life safety of patients or staff?	YES NO	
12.	Will activity significantly increase the flammable and combustible fire loading in non-hazardous spaces?	YES NO	
13.	Additional ILSM Considerations (as needed):	YES NO	
14.	Additional ILSM Considerations (as needed):	YES NO	

Additional Information or Requirements:	
Safety print name and signature:	Facilities/ Projects Representative print name and signature:
Date:	Date:

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

*This form is an evaluation tool and **NOT** intended to replace required project, compliance, or safety documentation.*

Instructions: Understanding that fire watch planning and implementation will require multiple steps, SCF Project Managers (PM) will coordinate at least 48 hours in advance when possible. A copy of the signed form(s) will be kept in the project file and made available upon request.

Signed and completed fire watch checklist must be routed to Safety (scfsafety@scf.cc) and the Facilities Project Manager.

Section 1: Fire Watch Requirements - Completed by SCF Project Manager – all fields required

Type of work (check all that apply):	<input type="checkbox"/> Hot Work <input type="checkbox"/> Fire Alarm System Impairment <input type="checkbox"/> Sprinkler System Impairment <input type="checkbox"/> Smoke or Fire Barrier Impairment <input type="checkbox"/> OTHER (explain):		
Building/ floor/ department/ room:			
Describe specific location and expected fire watch coverage:	-		
Project Manager Name with phone #, and email:	Name:	Phone #:	Email:
Expected Dates for planning and scheduling (estimated start and end date):	Date From:	Date To:	Frequency/ interval (30 min, 60 min, 120 min):

Section 2: Fire Watch Project Information

1.	Project Manager will provide ILSM and fire watch checklist as handoff to SCF Security.	Direct all questions to Project Manager
2.	SCF Security will: <ul style="list-style-type: none"> - Review ILSM, fire watch requirements, and documents. - Complete fire watch duties according to the frequency required and until notified work is complete. - Document fire watch checks on the attached log and submit to SCF Safety. - Know location of nearest fire extinguisher and alarm pull station in the fire watch area. - Activate Code Red emergency procedures immediately if smoke or fire is suspected or confirmed. 	Direct all questions to Supervisor, Project Manager, and/or Facilities Manager.

Printed Name and Signature of Project Manager (or designee): _____

Date: _____

Forward signed copy to: SCF Safety (scfsafety@scf.cc)

Floorplan and additional information as needed:

ATTACHMENT A: PRECONSTRUCTION RISK ASSESSMENT CHECKLIST

Interim Life Safety Measures (ILSM) Infection Prevention and Control (ICRA) Interim Utility System Measures (IUSM)

*This form is an evaluation tool and **NOT** intended to replace required project, compliance, or safety documentation.*

Instructions: PM to ensure the below answers are provided for each utility system. For any “YES” answers, indicate the duration of the measure and review the “Implemented IUSM” column details for the minimum requirements. Unless otherwise noted, the PM is responsible to implement all required IUSMs. Blank rows are provided to allow additional IUSMs as required for the safety of patients and staff and the preservation of the facility. PM to obtain proper review and approvals prior to beginning work.

Interim Utility System Measures (IUSM)

All permits, risk assessments, mitigating measures and procedures shall be in place before work begins.

Measure	IUSM Evaluation		Duration of IUSM dates/phase(s)	Implemented IUSM
1.	Domestic Water	YES NO		Complete ICRA & ILSM . Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
2.	Electrical	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
3.	Emergency Power	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
4.	Fire Detection	YES NO		Complete ILSM and evaluate for Fire Watch Contact information for person performing work:
5.	Fire Suppression	YES NO		Complete ILSM and evaluate for Fire Watch Contact <u>information</u> for person performing work:
6.	HVAC	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
7.	Medical Gas	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
8.	Pneumatic Tube	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
9.	Suction	YES NO		Follow Lock Out Tag Out procedures. Review and prepare emergency response plan specific to the work taking place. Coordinate with impacted department(s). Contact information for person performing work:
10	Other (explain):	YES NO		Explain: Contact information for person performing work:
Completed by:				Date:

Forward IUSM copy to: Safety (scfsafety@scf.cc)

**SECTION 01 41 00
REGULATORY REQUIREMENTS**

PART 1 – GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

- A. Regulatory requirements applicable to this project are the following:
- B. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- C. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- D. 29 CFR 1910 - Occupational Safety and Health Standards Current Edition.
- E. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments, Supplements, and codes referenced herein.
- F. NFPA 99 – Health Care Code
- G. FGI Guidelines – 2022 Facility Guidelines Institute for Design and Construction.
- H. IFC – International Fire Code – Current guidelines adopted by the State of Alaska.
- I. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 005213 – Agreement Form.
- C. Section 014000 - Quality Requirements.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 00
REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 005213 – Agreement Form.
- C. Construction Drawings, Technical Specifications, Architect’s Supplemental Instructions, Requests for Information, and Addenda.

1.02 SECTION INCLUDES

- A. Use of references in Drawings and Specifications, including requirements for copies of reference standards at Project site.
- B. Definitions and terms used in Specifications and Drawings, including abbreviations, acronyms, names, and terms which may be used in Specifications.

1.03 DEFINITIONS

- A. “Approved”: When used to convey Architect’s action on Contractor’s submittals, applications, and requests, “approved” is limited to Architect’s duties and responsibilities as stated in the Conditions of the Contract.
- B. “Directed”: A command or instruction by Architect. Other terms including “requested,” “authorized,” “selected,” “approved,” “required,” and “permitted” have the same meaning as “directed.”
- C. “Indicated”: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including “shown” “noted,” “scheduled,” and “specified” have the same meaning as “indicated.”
- D. “Regulations”: Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- E. “Furnish”: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. “Install”: Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar

operations.

- G. "Provide": Furnish and install, complete and ready for the intended use.
- H. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated. Comply with standard dates referenced in the International Building Code (IBC).
- C. Copies of Standards: Each entity engaged in construction on Project shall be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.
- D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the specification section.

1.05 USE OF REFERENCES

- A. References: The Drawings and Specifications contain references to various standards, standard specifications, codes, practices and requirements for products, execution, tests and inspections. These reference standards are published and issued by the agencies, associations, organizations and societies listed in this Section or identified in individual product specification Sections.
 - 1. Wherever term "Agency" occurs in Standard Specifications, it shall be understood to mean the term used for Southcentral Foundation for purposes of the Contract.

2. Wherever term "Engineer" occurs in Standard Specifications, it shall be understood to mean Architect or other responsible design professional for purposes of the Contract.
 3. Where reference is made to Standard Details, such reference shall be to the Standard Details accompanying the Standard Specifications.
- B. Relationship to Drawings and Specifications: Such references are incorporated into and made a part of the Drawings and Specifications to the extent applicable.
- C. Referenced Grades Classes and Types: Where an alternative or optional grade, class or type of product or execution is included in a reference but is not identified on the Drawings or in the Specifications, provide the highest, best, and greatest of the alternatives or options for the intended use and prevailing conditions.
- D. Copies of Reference Standards:
1. Reference standards are not furnished with the Drawings and Specifications because it is presumed that the Contractor, subcontractors, manufacturers, suppliers, trades, and crafts are familiar with these generally recognized standards of the construction industry.
 2. Copies of reference standards may be obtained from publishing sources.
- E. Jobsite Copies:
1. Contractor shall obtain and maintain at the Project site copies of reference standards identified on the Drawings and in the Specifications in order to properly execute the Work.
 2. At a minimum, the following shall be readily available, as applicable to the Work:
 - a. State Building Codes: As referenced in Section 01 41 00 - Regulatory Requirements.
 - b. Safety Codes: Occupational Safety and Health Act (OSHA) regulations and local and state Safety requirements and regulations.
 - c. General Standards:
 - 1) Underwriters Laboratories, Inc. (UL) Building Products Listing.
 - 2) Factory Mutual Research Organization (FM) Approval Guide.
 - 3) American Society for Testing and Materials (ASTM) Standards in Building Codes.
 - 4) American National Standards Institute (ANSI) standards.
 - d. Fire and Life Safety Standards: All referenced standards pertaining to fire rated construction and exiting.
 - e. Common Materials Standards: American Concrete Institute (ACI), American Institute of Steel Construction (AISC), American Welding Society

(AWS), Gypsum Association (GA), National Fire Protection Association (NFPA), and Tile Council of America (TCA) standards to the extent referenced within the Contract Specifications.

- f. Product Listings: Approval documentation, indicating approval of authorities having jurisdiction for use of product within the applicable jurisdiction.

F. Edition Date of References:

1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition enforced by the Authorities Having Jurisdiction as of the date of the Agreement, Contract Drawings and Contract Specifications.
2. All amendments, changes, errata, and supplements as of the effective date shall be included.

- G. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision, or amendment. It is presumed that the Contractor is familiar with and has access to these nationally- and industry-recognized specifications and standards.

1.06 DEFINITIONS OF TERMS

- A. Basic Contract Definitions: Words and terms governing the Work are defined in the Contract General and Supplementary Conditions, as referenced in the Agreement.
- B. Words and Terms Used on Drawings and in Specifications: Additional words and terms may be used in the Drawings and Specifications and are defined as follows:
1. "Applicable:" As appropriate for the particular condition, circumstance or situation.
 2. "Approve(d):" Approval action shall be limited to the duties and responsibilities of the party giving approval, as stated in the Conditions of the Contract. Approvals shall be valid only if obtained in writing and shall not apply to matters regarding the means, methods, techniques, sequences and procedures of construction. Approval shall not relieve the Contractor from responsibility to fulfill Contract requirements.
 3. "And/or:" If used, shall mean that either or both of the items so joined are required.
 4. "Directed:" Limited to duties and responsibilities of the Southcentral Foundation's Representative or Architect as stated in the Contract General Conditions, meaning "as instructed by SCF's Representative or Architect, in

writing, regarding matters other than the means, methods, techniques, sequences and procedures of construction. Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by SCF's Representative or Architect", "requested by the SCF's Representative or Architect", and similar phrases. No implied meaning shall be interpreted to extend the responsibility of the SCF's Representative, Architect or other responsible design professional into the Contractor's supervision of construction.

5. "Equal" or "Equivalent:" As determined by Architect or other responsible design professional as being equivalent, considering such attributes as durability, finish, function, suitability, quality, utility, performance, and aesthetic features.
6. "Furnish:" Means "supply and deliver, to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
7. "Indicated:" The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help the reader locate the reference. There is no limitation on location.
8. "Install:" Describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
9. "Installer:"
 - a. "Installer" refers to the Contractor or an entity engaged by the Contractor, such as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - b. "Experienced Installer:" The term "experienced," when used with "installer" means having a minimum of 5 previous Projects similar in size to this Project, knowing the precautions necessary to perform the Work, and being familiar with requirements of authorities having jurisdiction over the Work.
10. "Jobsite:" Same as site, Area of Work, or other similar term referencing the physical property where the work is to be carried out upon.
11. "Necessary:" With due considerations of the conditions of the Project and as determined in the professional judgment of the Architect or other responsible design professional as being necessary for performance of the Work in conformance with the requirements of the Contract Documents, but excluding matters regarding the means, methods, techniques, sequences, and procedures of construction.

12. "Noted:" Same as "Indicated."
13. "Per:" Same as "in accordance with," "according to" or "in compliance with."
14. "Products:" Material, system or equipment.
15. "Project Site:" Same as "Site." See definition of "Jobsite" above.
16. "Proper:" As determined by the Architect or other responsible design professional as being proper for the Work, excluding matters regarding the means, methods, techniques, sequences, and procedures of construction, which are solely the Contractor's responsibility to determine.
17. "Provide:" Means "furnish and install, complete and ready for the intended use."
18. "Regulation:" Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, as well as and rules, conventions and agreements within the construction industry that control performance of the Work.
19. "Required:" Necessary for performance of the Work in conformance with the requirements of the Contract Documents, excluding matters regarding the means, methods, techniques, sequences and procedures of construction, such as:
 - a. Regulatory requirements of authorities having jurisdiction.
 - b. Requirements of referenced standards.
 - c. Requirements generally recognized as accepted construction practices of the locale.
 - d. Notes, schedules and graphic representations on the Drawings.
 - e. Requirements specified or referenced in the Specifications.
 - f. Duties and responsibilities stated in the Bidding and Contract Requirements.
20. "Scheduled:" Same as "Indicated."
21. "Selected:" As selected by SCF's Representative, Architect or other responsible design professional from the full selection of the manufacturer's products, unless specifically limited in the Contract Documents to a particular quality, color, texture or price range.
22. "Shown:" Same as "Indicated."
23. "Site:" Same as "Site of the Work" or "Project Site;" the area or areas or spaces occupied by the Project and including adjacent areas and other related areas occupied or used by the Contractor for construction activities, either exclusively

or with others performing other construction on the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

- 24. "Supply:" See "Furnish."
- 25. "Testing Laboratory" or "Testing Laboratories:" An independent entity engaged to perform specific inspections or tests, at the Project Site or elsewhere, and to report on, and, if required, to interpret, results of those inspections or tests. Refer to Section 014000 – Quality Requirements.
- 26. "Testing and Inspection Agency:" Same as "Testing Laboratory."

1.07 ABBREVIATIONS, ACRONYMS, NAMES AND TERMS, GENERAL

- A. Abbreviations, Acronyms, Names and Terms: Where acronyms, abbreviations, names, and terms are used in the Drawings, Specifications, or other Contract Documents, they shall mean the recognized name of the trade association, standards generating organization, authority having jurisdiction or other entity applicable.
- B. Abbreviations, General: The following are commonly used abbreviations which may be found on the Drawings or in the Specifications. Refer to the Drawings for additional abbreviations or acronyms. This is a partial list. If there is any discrepancy or confusion, notify the University in writing by RFI:

AC or ac	Alternating current (or air conditioning, depending on context)
AMP or amp	Ampere
C	Celcius
CFM or cfm	Cubic feet per minute
CM or cm	Centimeter
CY or cy	Cubic Yard
DC or dc	Direct Current
DEG or deg	Degrees
F	Fahrenheit
FPM or fpm	Feet per minute
FPS or fps	Feet per second
FT or ft	Foot or feet
Gal or gal	Gallons
GPM or gmp	Gallons per minute
IN or in	Inches
Kip or kip	Thousand Pounds
KSI or ksi	Thousand pounds per square inch
KSF or ksf	Thousand pounds per square foot
KV or kv	Kilovolt

KVA or kva	Kilovolt amperes
KWH or kwh	Kilowatt hour
LBF or lbf	Pounds force
LF or lf	Lineal foot
M or m	Meter
MPH or mph	Miles per hour
MM or mm	Millimeter
PCF or pcf	Pounds per cubic foot
PSF or psf	Pounds per square foot
PSI or psi	Pounds per square inch
PSY or psy	Pounds per square yard
SF or sf	Square foot
Sy or sy	Square yard
V or v	Volts

- C. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- D. Undefined Abbreviations, Acronyms, Names and Terms: Words and terms not otherwise specifically defined in this Section, in the Instructions to Bidders, in the Contract General Conditions, on the Drawings or elsewhere in the Specifications, shall be as customarily defined by trade or industry practice, by reference standard and by specialty dictionaries such as the following:
1. Dictionary of Architecture and Construction, Fourth Edition (Cyril M. Harris, McGraw-Hill Book Company, 2005).
 2. Encyclopedia of Associations, published by Gale Research Co., commonly available in public libraries.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specifications apply to this section.
- B. Document 00 52 13 – Agreement Form.

1.02 SUBMITTALS

- A. Submit schedule of proposed connection and termination dates 15 days before implementation.
- B. Submit site plan showing temporary facilities, utility connections, and construction personnel parking areas.

1.03 QUALITY ASSURANCE

- A. Arrange and pay for Authorities Having Jurisdiction to approve each temporary utility before use. Obtain necessary certifications and permits.

1.04 PROJECT CONDITIONS

- A. Assume responsibility for operation, maintenance, and protection.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

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

2.02 TEMPORARY ELECTRICITY

- A. If required, Contractor shall provide and shall pay for power service required from utility source.
- B. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as required.
- C. Provide main service disconnect and overcurrent protection at convenient location.

2.03 TEMPORARY LIGHTING

- A. Provide and maintain lighting for constructions operations.
- B. Permanent building lighting may be utilized during construction only with written pre-approval from Owner.

2.04 TEMPORARY HEAT

- A. Provide and pay for heat devices and heat as required to maintain specified conditions for construction operations. Use equipment that will not have harmful effect on completed installation.
 - 1. Use permanent heating system, or provide vented, self-contained, liquid-gas, propane-gas, or fuel-oil heaters with individual space thermostatic control.
 - 2. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 3. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 4. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- B. Maintain minimum ambient temperature of 50 degrees F. in areas where construction is in progress, unless indicated otherwise in Specifications.

2.05 HUMIDITY CONTROL

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

2.06 TELEPHONE SERVICE

- A. Provide, maintain, and pay for mobile telephone service to field supervisor(s) at time of project mobilization through project completion.

2.07 COMPUTER AND COPY SERVICE

- A. Provide, maintain, and pay for computer service to field office at time of project mobilization.
- B. Provide, maintain, and pay for 8-1/2 x 11-inch copy machine in field

office.

2.08 TEMPORARY WATER SERVICE

- A. Existing water service may be used. Owner will pay cost of water used. Exercise measures to conserve water.
- B. If Owner provided water is not available or adequate, provide, maintain, and pay for suitable quality water required for construction.
 - 1. Extend branch piping with outlets located so water is available by hoses with threaded connections.
 - 2. Sterilize temporary water piping prior to use.

2.09 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain self-contained facilities and enclosures including toilets, wash facilities and drinking water, for use of construction persons.

2.10 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect adjacent properties from damage from construction operations. Coordinate all requirements for infection control with the Owner.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

2.11 FIELD OFFICES AND SHEDS

- A. Office: Suitable for Contractor field management and tool storage, weather-tight, with lighting, electrical outlets, heating equipment and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for project meetings, with table and chairs necessary to accommodate all attendees.
- C. Locate offices and sheds a minimum distance of 20 feet from existing structures unless Owner approves in writing.
- D. Provide fire resistant rated walls where closer than 30 feet to other permanent buildings or interior property lines. Not required at public right of way.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

3.02 WEATHER CONTROL

- A. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Specifications Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

3.03 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual Specifications Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.
- C. Provide protection covering at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

3.04 SECURITY

- A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

3.05 PARKING

- A. Coordinate with Owner to arrange for parking areas to accommodate

construction personnel.

- B. When site space is not adequate, provide additional off-site parking.
- C. Designate one parking space onsite for the Owner.

3.06 PROGRESS CLEANING

- A. Maintain work and storage area free of waste materials, debris, and rubbish. Maintain site in a clean and orderly conditions to maintain site passage and exits, and to avoid fire hazard.
- B. Provide waste-collection containers in sizes adequate to handle construction waste.
- C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the spaces.
- D. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
- E. Remove waste materials, debris, and rubbish from site periodically at least once weekly and dispose off-site.
- F. Open free-fall chutes not permitted. Terminate closed chutes into appropriate containers with lids.

3.07 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion Inspection.
- B. Remove underground installations to a minimum depth of two feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 00 52 13 – Agreement Form
- C. Section 01 40 00 - Quality Requirements
- D. Section 01 70 00 – Execution and Closeout Requirements

1.02 DEFINITIONS

- A. Products: New material, machinery, components, equipment, fixtures, and systems forming the Work. Products do not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
- B. Products may also include existing materials or components required for reuse where specified.
 - 1. Provide interchangeable components of the same manufacturer, for similar use products.
- C. Substitutions: Changes in products from those required by the Contract documents, proposed by the Contractor.
 - 1. Substitutions will not be accepted during Bidding.

1.04 PRODUCT SUBMITTALS

- A. Product List: Submit a list, showing proposed products. Include manufacturer's name and proprietary product names for each product.
 - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. Form: Tabulate information for each product under the following column heading:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.

- f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 - 3. Initial Submittal: Within 30 days after notice to proceed, submit initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 - 4. Completed List: Within 60 calendar days after notice to proceed to construction, submit product list. Include a written explanation for any omissions of data and for variations from Contract requirements.
 - 5. Architect's Action: Architect will respond in writing to Contractor within 7 calendar days, excluding SCF recognized holidays, of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit one request for each proposed substitution. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions.
 - 2. Show history of product in Alaska.
- C. Comparable Product Requests: Submit for each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- D. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt.

1.05 QUALITY ASSURANCE

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

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will

prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

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

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and freezing.

1.07 PRODUCT WARRANTIES

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

PART 2 – PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated

use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
3. Where products are accompanied by the term “as selected,” Architect will make selection.
4. Where products are accompanied by the term “match,” sample to be matched is Architect’s or existing construction.
5. Descriptive, performance, and reference standard requirements in the Specifications establish “salient characteristics” of products.
6. Or Equal: Where products are specified by name and accompanied by the term “or equal” or “or approved,” comply with product specification.

B. Product Selection Procedures:

1. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements.
2. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or with an unnamed manufacturer, that complies with requirements.
3. Visual Selection Specification: Where Specifications include the phrase “as selected from manufacturer’s colors, patterns, textures” or a similar phrase, select a product that complies with specified requirements.
 - a. Standard Range: Where Specifications include the phrase “standard range of colors, patterns, textures” or similar phrase, Architect will select color pattern, density, or texture from manufacturer’s product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase “full range of colors, patterns, textures” or similar phrase, Architect will select color, pattern, density, or texture from manufacturer’s product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

- A. See Specification Section 01 25 00 – Substitution Procedures.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered

form. Recycling does not include burning, incinerating, or thermally destroying waste.

- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

END OF SECTION

SECTION 01 76 10
TEMPORARY PROTECTIVE COVERINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 005213 – Agreement Form.
- C. Section 017000 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
 - 1. Impact resistant.
 - 2. Slip resistant.
 - 3. Flame retardant.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Remove dirt and debris from surfaces to be protected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Trim or overlap sheet materials to fit area to be covered.
- C. Roll out and cut rolled materials to fit area to be covered.

- D. Tape seams. Avoid taping directly to finished surfaces.
- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.

3.03 REMOVAL

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION

**SECTION 01 79 00
DEMONSTRATION AND TRAINING**

PART 1 – GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Items specified in individual product Sections.
 - 6. Conveying systems.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 00 & 01 Specifications apply to this section.
- B. Section 017000 - Closeout Submittals: Operation and maintenance manuals.
- C. Section 018100 - Commissioning: Additional requirements applicable to demonstration and training.
- D. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
 - 1. Make all submittals specified in this section, and indicated elsewhere for commissioning purposes, directly to the Commissioning Authority.
 - 2. Submit one copy to the Commissioning Authority, not to be returned.
 - 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 - 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

- B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Commissioning Authority for review and inclusion in overall training plan.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide 1 hard copy training manual for each attendee; allow for minimum of two attendees per training session. Provide an electronic copy of training manuals 48 hours in advance of training.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data (hard copy/physical manual and electronic manual).
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
 - 4. Include Commissioning Authority's formal acceptance of training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: MP4
 - 2. Label each video with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.
- B. Conduct training on-site unless otherwise indicated.
- C. Owner will provide classroom and seating at no cost to Contractor.
- D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- E. Provide training in minimum two-hour segments.
- F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.
- G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule

has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

- H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- I. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at a time and place to be determined.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's Project manager's and other tenants' on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Furniture and equipment
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.
 - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 1 hour after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate fire-retardant-treated materials and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Type A, Frameless
- D. Cabinet, Door, and Drawer Front Interface Style: Reveal overlay. Reveal dimension: ½ inch
 1. Walls: ¾-inch-thick plywood
 2. Lower backs: ¼-inch-thick hardboard melamine
 3. Upper backs: ½-inch-thick plywood melamine
 4. Shelves <32-inch span: ¾-inch-thick
 5. Shelves >32-inch span: ¾-inch-thick
 6. Drawers: ½-inch-thick birch sides, ¼-inch-thick hardboard bottom, routed into drawer sides, sanded smooth
 7. Backsplash: to match countertop thickness/material
 8. Door and Drawer Fronts: ¾-inch Birch or Maple banded door with hardwood veneer or GREENGUARD-certified high-pressure laminate laminated to 100% pre-consumer recycled wood fiber cores.
 9. All casework with enclosed shelving shall be adjustable.
 10. Cabinet doors perpendicular to adjacent wall to receive hinges that open to 85 degrees.
 11. Use cabinet door silencers, typical
 12. Stainless steel cabinet pulls with a minimum of 4-inch center-to-center mount
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- F. Laminate Cladding for Exposed Surfaces:
 1. Horizontal Surfaces: Grade HGS.
 2. Postformed Surfaces: Grade HGP.

3. Vertical Surfaces: Grade VGS.
 4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 5. Pattern Direction: Vertical.
- G. Materials for Semi exposed Surfaces:
1. Surfaces Other Than Drawer Bodies: Thermoset White Melamine Interior
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued dowel construction with fully captured bottoms.
- I. Colors, Patterns, and Finishes: As indicated in the Drawings “FINISH MATERIAL LEGEND”

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Plastic-Laminate-Faced Cabinets: ¾” Thick Softwood Plywood: DOC PS 1, medium-density overlay

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, nominal 110 degrees of opening, self-closing. Manufacturers limited to Blum, Haeefe, and Grass.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Shelf Rests: BHMA A156.9, B04013; metal.
- F. Drawer Slides: BHMA A156.9.
1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; type; zinc-plated steel with polymer rollers.
 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.

G. Door Locks: KitLock, KL 1200

H. Drawer Locks: KitLock, KL 1200

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: As recommended by cabinet manufacturer

2.5 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE (RB-1)

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet & resilient flooring.
 - 2. Thickness: 0.125 inch.

3. Height: 4 inches.
4. Lengths: Coils in manufacturer's standard length.
5. Base Installation" Article.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.
8. Colors: Johnsonite, Colors: 44 dark brown

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

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

- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
- C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- D. Sample Warranty: For special warranty.
- E. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.5 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-1)

- A. Manufacturer: Shaw Group
- B. Substitutions: Not Permitted
- C. Collection/Pattern: As indicated on drawings
- D. Color: As indicated on drawings
- E. Size: As indicated on drawings

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.

- C. Concrete Slabs: Verify that concrete slabs comply with ASTM F 710.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.

- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Flat: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Eggshell: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Satin: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Semi-Gloss: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss: 70 units and greater at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
- D. Colors: As indicated on drawings.
- E. Surplus: Provide three gallons of each paint color specified on the interior finish schedule for patching & repair.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer. but not less than the following:
 - 1. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. E. Gypsum Board Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.
 - 2. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

3. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer sealer, latex, interior, MPI #50.
- b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.

G. Aluminum Paint System:

- a. Prime Coat: Primer sealer, latex, interior, MPI #50.
- b. Intermediate Coat: Aluminum paint matching topcoat.
- c. Topcoat: Aluminum paint, MPI #1.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Corner guards.
 - 2. Impact-resistant wall coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples: For each exposed product and for each color and texture specified
- D. Maintenance Data
- E. Warranty: Sample of special warranty

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

- A. Surface-Mounted, Stainless Steel Corner Guards (CG-1): Assembly including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Basis of design product: Acrovyn, VA Series
 - 2. Sheet Thickness: .090"
 - 3. Corner Guard Height: 72" unless noted otherwise.
 - 4. Model: VA-200N
 - 5. Colors: Stainless Steel
 - 6. Trim and Joint Moldings:
 - 7. Mounting: Adhesive/Screws.

2.4 IMPACT-RESISTANT WALL COVERINGS

- A. Impact-Resistant Sheet Wall Covering (IRP-1) Fabricated from semi-rigid, plastic sheet wall-covering material.
 - 1. Basis of design product: Acrovyn
 - 2. Sheet Thickness: 0.060 inch.
 - 3. Sheet Height: 48" or as indicated on drawings
 - 4. Texture: Suede.
 - 5. Colors: as indicated on drawings
 - 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
 - 7. Mounting: Adhesive.

2.5 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
 - 1. Sheet Thickness of 0.060 Inch
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Where splices occur in horizontal runs of more than 20 feet splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
 - 3. Adjust end and top caps as required to ensure tight seams.
- C. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

GENERAL

RELATED DOCUMENTS

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

SUMMARY

Section Includes:

Solid surface material countertops.
Solid surface material sinks.

SUBMITTALS

Product Data: For countertop materials and sinks.

Shop Drawings: For countertops. Show materials.

Qualification Data: For fabricator.

Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer.

FIELD CONDITIONS

Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

COORDINATION

Coordinate locations of utilities that will penetrate countertops or backsplashes.

PRODUCTS

SOLID SURFACE COUNTERTOP MATERIALS

Manufacturer: Dupont Corian

Substitutions: Not Permitted

Solid Surface Type SSM-1

Style: Wilsonart

Color: 9175 Avalanche Melange

Thickness: 1/2 inch.

Size: Varies

COUNTERTOP FABRICATION

Fabricate countertops according to solid surface material manufacturer's written instructions.

Grade: Premium.

Front: Beveled 1 1/2-inch bullnose

Backsplash: Straight, slightly eased at corner.

End Splash: Matching backsplash.

Countertops: 1/2-inch- thick, solid surface material with front edge built up with same material.

Backsplashes: 1/2-inch- thick, solid surface material.

Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

Fabricate with loose backsplashes for field assembly.

Install integral sink bowls in countertops in the shop.

Joints: Fabricate countertops without joints.

Cutouts and Holes:

Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

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.

Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

INSTALLATION MATERIALS

Adhesive: Product recommended by solid surface material manufacturer.

Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

EXECUTION

EXAMINATION

Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned.

Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Supplemental requirements in addition to Division 1 - General Requirements applicable to all Divisions 20, 21, 22, 23, 25 - Mechanical specification sections.
- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200529 - Mechanical Hangers and Supports
 - 3. 200548 - Mechanical Vibration and Seismic Control
 - 4. 200553 - Mechanical Identification
 - 5. 200700 - Mechanical Insulation
 - 6. 221100 - Domestic Water Piping and Specialties
 - 7. 221300 - Sanitary Waste and Vent Piping and Specialties
 - 8. 224000 - Plumbing Fixtures
 - 9. 230131 - Duct Cleaning
 - 10. 230593 - Testing, Adjusting and Balancing
 - 11. 232113 - Hydronic Piping and Specialties
 - 12. 233100 - Ducts and Accessories
 - 13. 233600 - Air Terminal Units
 - 14. 233700 - Air Outlets and Inlets
 - 15. 255000 - Building Automation System
 - 16. 259000 - Sequence of Operations

1.2 REFERENCES

- A. Codes and Standards:
 - 1. Perform work in accordance with the legally enacted editions of applicable international, state, and local codes with locally accepted amendments to include:
 - a. 2021 International Building Code (IBC).
 - b. 2021 International Mechanical Code (IMC).
 - c. 2018 Uniform Plumbing Code (UPC).
 - d. 2020 NFPA 70, National Electric Code (NEC).
 - e. ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
 - f. Standard for Accessible and Usable Buildings and Facilities (ANSI A117.1-2009).
 - 2. Standards: Reference to the following standards infers that installation, equipment and material shall be within the limits for which it was designed, tested and approved, in conformance with the current publications and standards of the following organizations:
 - a. American Gas Association - AGA.
 - b. American National Standards Institute - ANSI.
 - c. American Society of Heating Refrigerating and Air Conditioning Engineers - ASHRAE.
 - d. American Society of Mechanical Engineers - ASME.
 - e. American Society for Testing and Materials - ASTM.
 - f. National Electrical Manufacturers' Association - NEMA.
 - g. National Fire Protection Association - NFPA.

- h. Sheet Metal and Air Conditioning Contractors National Association, Inc. - SMACNA.

B. Definitions:

1. "Accessible" means arranged so that an appropriately dressed man 6'-2" tall, weighing 250 pounds, may approach the area in question with the tools and products necessary for the work intended; and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation.
2. "Authority Having Jurisdiction" is the individual official, board, department, or agency established and authorized by the political subdivision created by law to administer and enforce the provisions of the Code as adopted or amended.
3. "As Specified" denotes a product, system, or installation that:
 - a. Includes salient characteristics identified in the Drawings and Specifications.
 - b. Meets the requirements of the "Basis of Design".
 - c. Is produced by a manufacturer listed as acceptable on the Drawings or in the Specifications.
4. "Basis of Design" refers to products around which the design was prepared. Some or all of the particular characteristics of Basis of Design products may be critical to the fit or performance of the completed installation. Such characteristics are often subtle. Where substitutions are made to products that are the Basis of Design, the Contractor is alerted that nominally acceptable substitutions may produce undesirable side effects such as products that no longer fit the space due to increased product dimensions. The Contractor is responsible for resolving impacts of substitutions. Approval of a substitution request does not relieve the Contractor of complying with the design intent and applicable Codes. Reference to a specific manufacturer's product (even as "Basis of Design") does not necessarily establish acceptability of that product without regard to compliance with other provisions of these specifications.
5. "Contracting Agency" is the Owner as defined in the General Conditions of the Contract.
6. "Demolish" means to permanently remove a component, equipment, or system and its appurtenances with no intent for reuse and to properly disposal of it.
7. "Furnish" means to purchase material as shown and specified and cart the material to an approved location at the site or elsewhere, as noted or agreed, to be installed by supporting crafts.
8. "Install" means to set in place and connect, ready for use and in complete and properly operating finished condition, material that has been furnished.
9. "Product" is a generic term that includes materials, equipment, fixtures and any physical item used on the project.
10. "Provide" means furnish products, labor, subcontracts, and appurtenances required and install to a complete and properly operating, finished condition.
11. "Remove" means to remove a component, equipment, or system and its appurtenances and either store it for re-installation/reuse, or turn it over to the Contracting Agency.
12. "Rough-in and Connect" means provide an appropriate system connection such as water services with stops, continuous wastes with traps, shutoff valves, and piping connections, testing, etc., for proper operation, ready for furnished products to be installed. Equipment furnished is received, uncrated, assembled and set in place by supporting crafts unless prior arrangements are made to hire the rough-in installer for this work.
13. "Serviceable" means arranged so that the component or product in question may be properly removed and replaced without disassembly, destruction or damage to the surrounding installation. "Serviceable" components shall be "accessible".

14. “Shop Drawings” are dimensioned working construction drawings drawn to scale to show an entire area of work in sufficient detail to demonstrate service and maintenance clearances and coordination of all trades.
15. “Substitution” is a product, system or installation that is not by a listed manufacturer or does not conform to all salient characteristics identified in the Project Manual, but that the Contractor warrants meets specific requirements listed in the Project Manual.
16. “System Drawing” is a diagrammatic engineered drawing that shows the interconnection and relationship between products to demonstrate how the products interact to accomplish the function intended. Examples of system drawings include plumbing diagrams, control and instrumentation diagrams, and wiring diagrams. Some drawings, such as dimensioned and complete Fire Suppression Drawings may be both System Drawings and Shop Drawings.

1.3 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Provide labor, products and services required for the complete installation, checkout, and startup of mechanical systems shown and specified. Coordinate related work, including the work of other crafts, to provide each system complete and in proper operating order.
2. Cooperate with others involved in the project; with due regard to their work, to promote rapid completion of the entire project.
3. Become thoroughly familiar with the local conditions under which the work is to be performed. Schedule work with regard to seasons, weather, climatic conditions, and other local conditions that may affect the progress and quality of the work.
4. Coordinate and perform demolition in support of the project whether or not such requirements are described on the Drawings. Restore systems that are to remain but that are affected in any way by demolition work. Conduct a site visit prior to bid to determine Scope.
5. In general, the mechanical, electrical, and building automation systems are interrelated. Coordinate the interface and operation of systems so that interrelated systems operate in proper synchronization and balance.
6. Provide labor, materials, and equipment to facilitate the commissioning process of systems and equipment within this scope of work. Perform tests and verification procedures required for the commissioning process as requested by the Contracting Agency.
7. Work and materials shall be in accordance with requirements of the applicable State and local Codes, regulations and ordinances, and the rules and regulations of other Authorities Having Jurisdiction. Nothing in drawings and specifications shall be construed to permit work not in conformance with applicable codes, rules, and regulations.
8. Where drawings or specifications call for a material or construction of a better quality or larger sizes than required by the above-mentioned Codes, rules and regulations, the provision of the specifications shall take precedence.
9. Furnish without any extra charge any additional material and labor when required for compliance with the listed codes, rules and regulations, even though the work may not be mentioned in the specifications or shown on the drawings. It is the responsibility of the successful bidder to bid in accordance with the minimum requirements of the applicable codes, rules, and regulations.

1.4 CONSTRUCTION PHASING REQUIREMENTS

- #### A.
- The facility will remain operational throughout the project construction. Project will require construction phasing to minimize impacts to facility operations. Contractor will be required to

develop and coordinate construction phasing plans with Owner. Refer to Architectural and Division 1 for additional information.

1.5 PRE-INSTALLATION MEETINGS

- A. Meet with and coordinate Divisions 20, 21, 22, 23, 25 work with the interrelated work of other trades including Architectural, Structural, Mechanical and Electrical to identify and resolve potential conflicts.
- B. Prior to installation of any Division 20, 21, 22, 23, and 25 component, coordinate installation with trades responsible for portions of other related sections of the Project Manual.

1.6 SUBMITTALS

- A. Refer to Division 1 for general submittal requirements for the items listed below, supplemented with the additional requirements listed. In addition, prepare Divisions 20, 21, 22, 23, 25 submittals in accordance with the following, to include any supplemental requirements listed in the specific specification section:
- B. General:
 - 1. The Contracting Agency's obligation to review submittals and to return them in a timely manner is conditioned upon the prior review and approval of the submittals by the Contractor as required by the Construction Contract.
 - 2. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Project Manual.
 - a. Submittals will not be checked for quantity, dimension, fit, or for proper technical design of manufactured equipment.
 - b. Provision of a complete and satisfactory working installation is the responsibility of the Contractor.
 - 3. Furnish suppliers with the applicable portions of the Project Manual and review and verify that the suppliers' submittals clearly represent products which comply with the Project Manual.
 - 4. Master Submittal Log
 - a. Create and maintain a master submittal log for items submitted in Divisions 20, 21, 22, 23, 25, including test results, certifications, record drawings, etc.
 - b. Submit master submittal log, independent of other submittals, as the first submittal for review and approval by the Contracting Agency.
 - c. Update submittal log with each submittal action.
 - d. Share an electronic copy with Contracting Agency and Engineer at two week intervals, or as requested by the Contracting Agency.
- C. Coordination:
 - 1. Prior to a submittal's submission for approval, hold a meeting of all construction trades to review shop drawings and submittals. Each trade shall cross-check shop drawings and submittals for conflicts, clearances, physical space allocation and routing, discrepancies, dimensional errors, omissions, contradictions, departures from the Contract requirements, correct electrical/mechanical services and connections, and provisions for commissioning.
 - 2. Review, revise, correct, and appropriately annotate submittals prior to submission for approval.
 - 3. Keep a current copy of approved submittals and the submittal log at the job site.

D. Electronic Submittals:

1. Provide electronic submittals in PDF format in addition to hard copy submittal. Maximum file size to be coordinated with Contracting Agency.
2. Follow the organization and formatting required for paper submittals.
3. Provide electronic bookmarks within the PDF document in place of tabs and sub-tabs.
4. If individual PDF files are provided for a product or shop drawing sheet(s), organize files into folders and name files and folders to correspond with applicable specification sections or drawing titles.
5. Create PDF documents without security, to be searchable, and to allow copy and paste. For scanned documents, run the optical character recognition (OCR) function to ensure the document is searchable and can be copied and pasted.
6. Reduce PDF file size by removing data and file creation elements not needed for final file presentation.

E. Product Data:

1. General:
 - a. This section describes in detail the preparation of mechanical product submittals. Submittals not provided as described shall be rejected without review. This procedure is designed to accelerate and improve the accuracy of the technical review process, as well as, simplify the preparation of the Installation, Operation, and Maintenance Manuals (IO&Ms).
 - b. Product data for each specification section shall be submitted in one complete package, except as noted in this section.
2. Submittal Organization:
 - a. Organize product submittal information in the same order as the products are specified. Provide a separate tabbed divider for each Divisions 20, 21, 22, 23, 25 specification section. Provide the typed section number on each tab.
 - b. Within each section, organize product information in the same order as products are specified in Part 2 of each applicable specification section. Provide sub-tabs within each section for each separate product article. Provide the typed product article number on each tab.
 - c. Provide product submittal information for each product specified in 8-1/2" x 11" format. Fold-out 11" x 17" format is also acceptable.
 - d. If a particular specified product is being omitted from the product submittal or will not be used for the project, provide a single sheet within the article tab identifying the product and annotated with a brief reason why the product is not being submitted, for example: "NOT USED," NO SUBMITTAL REQUIRED," "TO BE SUBMITTED BY (PROVIDE DATE)," etc. This will inform the reviewer that the product was not overlooked.
 - e. Partial submittals from individual subcontractors may be provided which cover a particular sub-contractor's scope of work. In this case, arrange partial submittals by system classification such as: PLUMBING, HEATING, FIRE SUPPRESSION, VENTILATION, BUILDING AUTOMATION SYSTEM, etc. Within each system classification, arrange product submittals by specification section, as described, such that each specification section can easily be reorganized into a master set of Divisions 20, 21, 22, 23, 25 product submittals organized by specification section. This will greatly simplify the preparation of IO&M manuals as described below.
 - f. Bind product submittal information in identical 3 inch wide, hard-backed, loose-leaf, 3 ring binders with clear front and spine insert pockets. Divide information into multiple volumes so that the pages in each binder rest naturally on one side of rings.

- g. Provide a master table of contents at the front of each volume which lists the Divisions 20, 21, 22, 23, 25 specification sections and indicates which sections are located within each volume.
 - h. Provide a table of contents within each section which lists the Part 2 products for that section in the same order as the applicable specification section.
 - i. Provide identical cover and spine inserts for each product submittal volume, to include the following typed information:
 - 1). The Contracting Agency Name.
 - 2). Project Name.
 - 3). Contractor Name.
 - 4). Subcontractor Name preparing the submittal.
 - 5). Date that the submittal or resubmittal was initiated.
 - 6). "Mechanical Product Submittals" or "Plumbing Product Submittals" etc. as appropriate.
 - 7). "Volume 1 of X, Volume 2 of X," etc.
3. Product Information:
- a. Indicate manufacturer's name and address, and local supplier's name, address, phone number.
 - b. Indicate each product as "Basis of Design", "Specified Equal" or "Proposed Substitution."
 - c. Identify catalog designation and/or model number.
 - d. Provide manufacturer's product literature. Neatly annotate to indicate specified salient features, appurtenances and performance criteria for each product specified to demonstrate compliance with the Project Manual to include scheduled information, drawing information and specified information.
 - e. Indicate product deviations from the Project Manual and mark out non-applicable items on generic "cut-sheets."
 - f. Include manufacturer provided dimensioned equipment drawings with rough-in mechanical and electrical connections.
 - g. Include operation characteristics, performance curves and rated capacities.
 - h. Include motor characteristics and wiring diagrams.
 - i. Include weight of equipment. Including accessories.
 - j. Provide basic manufacturer's installation instructions.
4. Product Substitutions:
- a. Clearly indicate both in the section table of contents and on the individual product submittal information each proposed substitution, deviation or change from the product as described in the Project Manual.
 - b. Submittal approval does not include substitutions, deviations or changes from the requirements of the Project Manual unless they are specifically itemized and approved. The term "No Exceptions Taken" will not apply to substitutions, deviations or changes not clearly identified.
 - c. Provision of a satisfactory working installation of equal quality to the system as described in the Project Manual shall be the responsibility of the Contractor.
 - d. Correct unapproved deviations from the Project Manual discovered in the field as directed by and at no additional cost to the Contracting Agency.
 - e. Cost of any design modifications as a result of proposed product substitutions shall be borne by the Contractor.

- F. System Drawings:
1. Submit System Drawings for dynamic elements/systems of the project which are performance specified to include but not limited to: Fire Suppression Systems, Building Automation Systems and stand-alone packaged equipment.
 2. Prepare system drawings on full sized sheets of the same size as the original construction drawings.
 3. Include with each system a sequence of operation narrative which describes each mode of system operation in sufficient detail to demonstrate compliance with the Project Manual to the satisfaction of the Contracting Agency.
- G. Shop Drawings:
1. General:
 - a. The Project Manual documents are not intended for nor are they suitable for use as shop drawings. Project Manual documents shall not be utilized for the actual fabrication or installation of products or equipment.
 - b. The Drawings are partly diagrammatic and do not show all offsets in piping or ducts and may not show in minute detail all features of the installation; however, provide systems complete and in proper operating order.
 - c. Locations of products are approximate unless dimensioned.
 - d. Divisions 20, 21, 22, 23, 25 products and systems shall not be installed without shop drawings approved by the Contracting Agency.
 - e. Rework, changes or additional engineering support required as a result of the installation of products and systems prior to the approval of applicable shop drawings by the Contracting Agency shall be provided at the Contractor's expense.
 - f. Drawing symbols used for basic materials, equipment and methods are commonly used by the industry. Special items are identified by a supplementary list of graphical illustrations, or identified on the drawings or specifications.
 2. Preparation:
 - a. Review each Divisions 20, 21, 22, 23, 25 specification section and identify the shop drawing requirements.
 - b. Combine the shop drawing requirements first by system (i.e. ventilation system, heating system, plumbing system, etc.) and then by area (i.e. fan room, boiler room, etc.).
 - c. Prepare shop drawings on full sized sheets of the same size as the original construction drawings.
 - d. Arrange shop drawings to scale, showing dimensions where accuracy of location is necessary for coordination or communication purposes.
 - e. Incorporate the actual dimensions and configurations of the products and systems approved through the product submittal process into the shop drawings.
 - f. Provide dimensioned maintenance clearance areas around each product as recommended by the manufacturer.
 - g. Coordinate Divisions 20, 21, 22, 23, 25 work with the interrelated work of other trades including Architectural, Civil, Structural, and Electrical.
 - h. Identify and provide recommendations to resolve major conflicts which may impact the design of the systems as shown. Such conflicts will be resolved during the shop drawing review process.
 - i. Identify locations where field coordination between various trades is necessary to avoid conflicts.
 - j. Indicate elevation of piping, ductwork and equipment above or below finished floor at various locations and in sufficient detail to demonstrate clearance from structural elements and the work of other trades.

- k. Coordinate placement of openings and holes through structure, walls, floors, ceilings, and roof with Structural and Architectural.
3. Submittal:
 - a. Submit dimensioned shop drawings as specified to demonstrate proper planning and sequencing of the applicable trades for the installation and arrangement of Divisions 20, 21, 22, 23, 25 with respect to other interrelated work.
 - b. Partial shop drawings submittals (i.e. heating system only) will be rejected without review, as the interrelationship with other related work and overall system fit cannot be evaluated.
 - 1). Underslab shop drawings may be submitted separately for review to accommodate the construction schedule.
 - c. It is assumed that shop drawings submitted for review have been thoroughly prepared and coordinated and that the products and systems can and shall be installed as shown. Conflicts which are not clearly identified and annotated on the submitted shop drawings are assumed not to exist.
 - d. Installation conflicts arising from the failure to properly coordinate the work of related trades shall be provided at the Contractor's expense.
- H. Certificates:
1. Review the submittal requirements for Certificates for each Divisions 20, 21, 22, 23, 25 specification section.
 2. Submit copies of certificates as specified. This information may be included within the Installation, Operations and Maintenance (IO&M) Manuals as determined by the Contracting Agency.
- I. Test and Evaluation Reports:
1. Review the submittal requirements for Test and Evaluation Reports for each Divisions 20, 21, 22, 23, 25 specification section.
 2. Submit copies of reports as specified. Also include these reports within the Installation, Operations and Maintenance (IO&M) Manuals as determined by the Contracting Agency.
- J. Installation, Operations and Maintenance (IO&M) Manuals:
1. Review the submittal requirements for IO&M manuals for each Divisions 20, 21, 22, 23, 25 specification section.
 2. Begin the preparation of the mechanical IO&M manuals with a complete and fully approved set of mechanical product data submittals organized, annotated and with the product information as indicated within the "Product Data" submittals article above and in each Divisions 20, 21, 22, 23, 25 section.
 3. Next, augment each individual product submittal with the written installation, operations and maintenance information for each approved product. This type of information is not applicable (or available) for bulk commodity or simplistic products such as copper pipe, basic pipe hangers or equipment tags, etc.
 4. Annotate the installation, operations and maintenance information to indicate applicable information for the specific equipment model(s) installed.
 5. Maintenance information shall include:
 - a. Preventive maintenance requirements for each product, including the recommended frequency of performing each preventive maintenance task.
 - b. Instructions for troubleshooting, minor repair and adjustments required for preventive maintenance routines, limited to repairs and adjustments that may be performed without special tools or test equipment and that require no extensive special training or skills.

- c. Information of a maintenance nature covering warranty items, etc., that have not been discussed in the manufacturers' literature.
- d. Information on the spare and replacement parts for each product and system. Properly identify each part by part number and manufacturer.
- e. Recommended spare parts list.
6. Organize the IO&M manual information by specification section (not by sub-contractor) with a tabbed divider separating each section. Provide the typed section number on each tab.
7. Within each section, organize the product information in the same order as the products are specified in Part 2 of each applicable section. Provide sub-tabs within each section for each product. Provide the typed product article number on each tab.
8. Bind the information in identical 3 inch wide; hard-backed, loose-leaf, 3 ring binders with clear front and spine insert pockets. Divide information into multiple volumes so that the pages in each binder rest naturally on one side of rings.
9. Provide a master table of contents at the front of each volume which lists the Divisions 20, 21, 22, 23, 25 specification sections and indicates which sections are located within each volume.
10. Provide a table of contents within each section which lists the Part 2 products for that section in the same order as the applicable specification section.
11. Provide identical cover and spine inserts for each IO&M manual volume, to include the following typed information:
 - a. The Contracting Agency Name.
 - b. Project Name.
 - c. "Mechanical Installation, Operations and Maintenance Manual".
 - d. "Volume 1 of X, Volume 2 of X," etc.
12. Submit copies of Operation and Maintenance Manuals in electronic format (Adobe PDF).

1.7 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Review the manufacturer's warranty requirements for each Divisions 20, 21, 22, 23, 25 specification section. Unless stated otherwise, provide 1-year warranty.
2. Submit required warranty documentation to the applicable Manufacturer's Representative to validate standard manufacturer's warranty for each required product. Obtain written confirmation of receipt from each applicable Manufacturer's Representative.
3. Provide Contracting Agency one copy of submitted warranty documentation and written confirmation of receipt for each applicable Manufacturer's Representative. This information may be included within the Operations and Maintenance (IO&M) Manuals as determined by the Contracting Agency.
4. Provide statement of Contractor's warranty of workmanship, labor, and materials, as described under Article 1.12 Warranty below.

B. Record Documentation:

1. General: As the Work progresses, neatly annotate a designated and otherwise unused set of Divisions 20, 21, 22, 23, 25 Contract Drawings to show the actual locations and routing of Divisions 20, 21, 22, 23, 25 Work and the terminal connection points to related Work. As a minimum, include the following:
 - a. Annotate record drawings to incorporate each applicable addendum.
 - b. Annotate record drawings as directed by each applicable Request for Information (RFI) and accepted Change Order Proposal.

- c. Modify record drawings to show actual equipment sizes and locations and pipe and duct routing. Revise pipe and duct sizes as appropriate.
 - d. Provide dimensioned locations for permanently concealed piping and ductwork (i.e. piping cast in concrete or buried underground/underslab).
 - e. Show the actual locations of system isolation valves, especially valves which are concealed above ceilings and behind access panels.
2. Preparation:
- a. Neatly annotate record drawings to provide clear interpretation to support electronic drafting by a third party.
 - b. Tape electronic sketches from addendums and/or RFIs directly to the record drawings as overlays.
 - c. Annotate the record drawings in colored pencil using the same symbols and abbreviations as indicated in the Divisions 20, 21, 22, 23, 25 legends and schedules of the Contract Drawings.
 - 1). Red to add information.
 - 2). Green to delete information.
 - 3). Blue to provide additional clarifying information which is not to be drafted.
 - d. After submittal to the Contracting Agency, provide additional clarification, information or rework as necessary to support the accurate interpretation and electronic drafting of the record drawings.
3. Submittals:
- a. Provide dimensioned underslab record drawings to the Contracting Agency prior to placing the slab. For slabs placed in multiple sections, provide record drawings for the applicable slab sections to the Contracting Agency prior to each pour.
 - b. Provide complete record drawings for concealed areas (i.e. above lay-in and hard ceilings and inside walls) to the Contracting Agency prior to concealment.
 - c. Provide the remaining portion of the record drawings for exposed areas to the Contracting Agency prior to the final completion of the project.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts:
1. Furnish spare parts for systems and equipment as listed in applicable sections of Divisions 20, 21, 22, 23, 25.
 2. Clearly label each part with name, manufacturer's part number, system and/or equipment where used and location.
 3. Deliver parts to location and person designated by the Contracting Agency, in durable storage boxes.
 4. Group cartons containing smaller items by system or application and deliver in an appropriate number of storage boxes.
- B. Extra Stock Materials:
1. Furnish extra stock as listed in applicable sections of Divisions 20, 21, 22, 23, 25.
 2. Clearly label with name, manufacturer's part number, system and/or equipment where used and location.
 3. Deliver to location and person designated by the Contracting Agency, in durable storage boxes.
- C. Tools: Provide three sets of special tools and testing and monitoring equipment as listed in applicable sections of Divisions 20, 21, 22, 23, 25.

1.9 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: Companies specializing in manufacturing the Products specified in the Divisions 20, 21, 22, 23, 25 sections with minimum 3 years documented experience.
2. Fabricators: Companies specializing in fabricating the Products specified in the Divisions 20, 21, 22, 23, 25 sections with minimum 3 years documented experience.
3. Installers: Perform the Work using qualified workmen that are experienced and usually employed in the trade.
4. Testing Agencies: Products requiring electrical connection shall be listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and as indicated.

B. Product Testing and Certification:

1. Nationally Recognized Testing Laboratory (NRTL) Labeling: Electrical equipment and conductors shall be "Approved," "Certified," "Identified," or "Listed" and "Labeled" to establish that the electrical equipment is safe, free of electrical shock and fire hazard, and suitable for the purpose for which it is intended to be used. The manufacturer shall have the specific authorization of one of the Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratories (NRTLs) in accordance with the applicable national standards to label the equipment as suitable.
2. Where the words Listed, UL Listed, UL Labeled, Underwriters Laboratories, Inc., UL, or variations of this terminology, appear under this Division of the Specifications or the associated drawings, it is understood that a comparable testing agency as defined by NRTL above is acceptable.
3. Such testing and certification is generally applicable to products within the following categories:
 - a. Life safety and fire suppression.
 - b. Fuel burning equipment, except certain classes of power or industrial equipment for which other recognized certification applies as well.
 - c. Factory fabricated and wired electrical control panels and packaged equipment with factory installed electrical controls or panels.
 - d. Components for life safety systems, fuel systems and medical gas systems.
4. The listing under Paragraph '3' above is provided for illustration of requirements and is not exclusive. Provide products that have been tested and listed for the intended application when such products are available unless the Contracting Agency has provided written exemption on an itemized basis.
5. Provide electrical products listed and labeled by UL, FM, ETL or other approved NRTL. If listing and labeling is not available, stamp the submittal for these products by an Alaska Registered Professional Engineer approved by the Authority Having Jurisdiction, at no additional cost.
6. Where interpretation is required, the Contracting Agency will provide direction and will be the sole judge in cases of compliance with this subsection.

1.10 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Verify products are new and delivered in original factory packaging/crating and are free from damage and corrosion.
2. Replace products delivered to job site that does not comply with above requirements at no expense to Owner.

3. Remove damaged, or otherwise unacceptable, products from the project site when directed by the Contracting Agency.

B. Storage and Handling Requirements:

1. Store products in covered storage area protected from the elements, outside the general construction area until installed. Maintain ambient conditions required by manufacturer of each product.
2. Store products in original factory packaging until actual installation.
3. Handle items carefully to avoid breaking, chipping, denting, scratching, or other damage.
4. Replace damaged items with same item in new condition.

1.11 WARRANTY

- A. See Division 1 for general warranty requirements.
- B. Warranty workmanship, labor, and materials for a period of one year from the date of final acceptance, without limitation, except where longer warranty periods are specified in a specific Section under this Division, or in the General Conditions of the Contract. Promptly coordinate and perform Warranty work at the Contractor's sole expense.
- C. Submit necessary documentation to each appropriate Manufacturer's Representative to validate manufacturer's warranty.
- D. Provide one copy of warranty documentation and confirmation receipt from the Manufacturer's Representative.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 1. Cover and protect open ends and individual components of the ventilation and piping systems during construction when dust, dirt, debris, overspray, or other potential construction contaminants could enter the air distribution system or elements (ducts, fans, VAV boxes, silencers, etc.).
 2. Provide temporary construction filters over return airshaft openings and at air handling unit return air dampers.
- B. Demolition/Removal:
 1. Examination:
 - a. Drawings involving existing conditions are based on building record drawings and limited field observation.
 - b. Conduct a site inspection prior to submission of Bid to become thoroughly familiar with the Scope of Work.
 - c. Report discrepancies to the Contracting Agency before disturbing existing installation.

- d. Verify field measurements, locations, sizes, and routing arrangements and site conditions.
- e. Commencement of demolition implies Contractor accepts existing conditions.
- 2. Preparation:
 - a. This facility will remain occupied during construction. Coordinate with the Contracting Agency in advance before scheduling disruption of services.
 - b. Accommodate the Contracting Agency's normal business schedule to the maximum extent possible.
 - c. Provide temporary mechanical systems to maintain existing systems in service during construction. Submit plan for providing temporary services for approval.
 - d. Cover and protect open ends and individual components of the ventilation and piping systems during construction when dust, dirt, debris, overspray, or other potential construction contaminants could enter the air distribution system or elements (ducts, fans, VAV boxes, silencers, etc.).
 - e. Provide temporary construction filters over return air openings and at air handling unit return air dampers.
 - f. When work must be performed on operating equipment or systems, use personnel experienced in the operation of the specific equipment affected.
 - g. Submit work plan and schedule for approval prior to beginning work.
 - h. Notify the Contracting Agency and the Fire Department Agencies at least 24 hours before partially or completely disabling Fire Suppression, Alarm, or Notification Systems.
 - i. Notify the Contracting Agency at least 24 hours before beginning welding or other 'hot' work.
- 3. Execution:
 - a. Remove, relocate, and extend existing installations to accommodate new construction as shown and as required for phasing or final systems operations.
 - b. Disconnect and remove abandoned fixtures, terminal units, and other products. Remove abandoned controls and associated wiring to source of signal and supply.
 - c. Remove abandoned piping and ductwork back to source of supply or other point as shown, and cap tight to accept normal system test pressures.
 - d. Remove exposed abandoned or indicated for demolition controls, equipment, pipes and ducts, including abandoned items above ceiling finishes. Cut concealed pipes and ducts flush with walls and floors. Remove brackets, stems, hangers and other accessories. Fill and repair surfaces to match surrounding finish work.
 - e. Repair damaged surfaces, insulation, ceiling tiles, and fireproofing. Plug, patch, repair holes, and surfaces. Repair assemblies to match existing fire, temperature, and/or smoke ratings. Refinish surface to match surrounding finish work.
 - f. Seal room penetrations to maintain pressure relationships to adjacent spaces.
 - g. Maintain access to existing mechanical and electrical installations that remain active. Modify installation or provide access panels as appropriate; coordinate with the Contracting Agency.
 - h. Turn salvaged items over to the Contracting Agency as noted on the Drawings. Dispose of items that the Contracting Agency does not desire to retain at a legal disposal site.

3.2 INSTALLATION

- A. Interface with Other Work:
 - 1. Electrical Work:
 - a. Coordinate with Division 26.

- b. Suggested Coordination Schedule: The Contractor is responsible to provide heating, ventilating, and plumbing equipment motors and controls, including fire suppression controls. Unless otherwise indicated on the Drawings, it is recommended that motors and controls be furnished, set in place, and wired in accordance with the following schedule. "CC" applies to either a Control subcontractor working as a sub to the General Contractor or to the Divisions 20, 21, 22, 23, 25 Mechanical subcontractor. Coordinate work between subcontractors.

MC - Divisions 20, 21, 22, 23, 25-Mechanical CC - Divisions 20, 21, 22, 23, 25-Controls EC - Divisions 26, 27 and 28-Electrical	Furnished By	Set in Place By	Power By	Control By
Equipment Motors	MC	MC	EC	CC
*Magnetic motor starters:				
Automatic controlled, w/ or w/o HOA switches	EC	EC	EC	CC
Automatic controlled, w/ or w/o HOA switches, and that are furnished as part of factory wired equipment	MC	MC	EC	MC
*Manual Motor Starters:				
Manually controlled	EC	EC	EC	EC
Manually controlled, and that are furnished as part of factory wired equipment	MC	MC	EC	MC
Combination disconnect and motor starter	EC	EC	EC	CC
Motor Control Centers	EC	EC	EC	CC
Variable Speed Drives	MC	EC	EC	CC
Push-button stations, pilot lights, contactors, multi-speed switches	EC	EC	EC	EC
Disconnect switches, thermal overload switches, manual operating switches	EC	EC	EC	--
Multi-speed switches furnished as part of factory wired equipment	MC	MC	EC	MC
Temperature control relays, transformers, electric thermostats, time clocks, etc., that are not part of factory furnished equipment	CC	CC	CC	CC
Remote bulb thermostats, motor valves, controls, which are an integral part of factory furnished mechanical equipment.	MC	MC	EC	MC
Fire sprinkler suppression controls	MC	MC	EC	MC
Duct smoke detectors, including relays for fan shutdown	MC	MC	EC	EC
Fire/Smoke Dampers	MC	MC	EC	EC
Control Systems	CC	CC	CC	CC
Damper & Valve Actuators (120 v)	CC	CC	EC	CC

MC - Divisions 20, 21, 22, 23, 25-Mechanical CC - Divisions 20, 21, 22, 23, 25-Controls EC - Divisions 26, 27 and 28-Electrical	Furnished By	Set in Place By	Power By	Control By
Damper & Valve Actuators (24 v)	CC	CC	CC	CC
Boiler and water heater controls, boiler burner control panels, internally wired	MC	MC	EC	MC

* Provide starters in accordance with the Electrical Division of these Specifications. Note that a thermal overload relay in each phase is required for each starter (packaged equipment included).

3.3 REPAIR/RESTORATION

- A. Touch-up, repair or replace product components broken during installation or startup with new replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.
- C. Clean and repair existing identification tags/labels, hangers, supports, insulation, materials, instrumentation, and equipment that remain or are to be reused or are affected by this work. Materials and equipment which require major repair may be replaced at the Contractor’s option.
- D. Plug, patch and repair surfaces, adjacent construction, and finishes damaged during demolition and new work. Restore to original condition or better including fire, smoke or temperature ratings or listings. Retexture surfaces to match surrounding surfaces. Repaint affected surfaces, with extent of paint to include adjacent surfaces to next wall or other clean break to avoid mismatched finish. Replace cracked or damaged ceiling tiles. Repair fire proofing, assembly fire ratings, and construction resistant to the passage of smoke.

3.4 SITE QUALITY CONTROL

- A. Site Tests and Inspections:
 - 1. The Contracting Agency may inspect and approve sample installation of systems and equipment prior to general installation of units.
 - 2. Schedule, obtain, and pay for fees and/or services required by the local Authorities Having Jurisdiction and by these specifications, to test the mechanical systems.
 - 3. Notify the Contracting Agency a minimum of 24 hours in advance of tests. Certify in writing that specified tests have been made in accordance with the specifications.
 - 4. Immediately correct deficiencies that are discovered during the tests and repeat tests until system is approved. Do not cover or conceal piping, equipment, or other portions of the mechanical installations until satisfactory tests are made and approved.
 - 5. Under the direction of the Contractor and in the presence of the Contracting Agency, place the entire mechanical installation and/or any portion thereof in operation to demonstrate satisfactory operation.
 - 6. Arrange for the Contracting Agency to witness tests. The Contracting Agency may waive witnessing any specific test at its discretion.
- B. Non-Conforming Work:
 - 1. Expediently remove and provide new for work not conforming to the Project Manual upon discovery; including warranty and discovery periods.

2. Warranty period shall start over for replaced equipment and installation from the date of accepted by the Contracting Agency.

C. Manufacturer Services:

1. Authorized manufacturer's representative shall be on-site for testing, start-up, functional check-out, and commissioning of equipment and systems.
2. Procurement, installation, start-up, and warranty services to be provided by manufacturer's authorized representative and service company.
3. Equipment, devices, hardware, and software to be approved for application, and of current production. Original manufacturer's parts, hardware, software, and support to be available for ten years after installation.

3.5 CLEANING

- A. Upon completion of installation and prior to initial operation, remove debris, and clean and wipe down equipment, piping, ductwork and floor to eliminate dust and dirt.

3.6 CLOSEOUT ACTIVITIES

- A. Demonstration: Provide demonstration, conducted by authorized factory start-up personnel, to the Contracting Agencies authorized personnel as listed in each individual specification section.
- B. Training: In addition to training specified in each individual specification section, provide 4 additional hours of operational instruction conducted by qualified personnel, covering any of the mechanical systems and installation requested by the Contracting Agency to its authorized maintenance personnel.

3.7 PROTECTION

- A. Provide finished products with protective covers during balance of construction.
- B. Provide open duct ends, grilles, and diffusers with protective covers during balance of construction.
- C. Provide open pipe ends with protective caps during balance of construction.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. General hanger and support requirements for building service piping and mechanical equipment not required to be vibration and/or seismically controlled.
 - 2. Penetrations, sleeves, and seals.
- B. Products Installed But Not Supplied Under this Section: Vibration Isolation and Seismic Control anchoring and support systems furnished by Section 200548 - Mechanical Vibration and Seismic Control.
- C. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200548 - Mechanical Vibration and Seismic Control
 - 3. 200553 - Mechanical Identification
 - 4. 200700 - Mechanical Insulation
 - 5. 221100 - Domestic Water Piping and Specialties
 - 6. 221300 - Sanitary Waste and Vent Piping and Specialties
 - 7. 224000 - Plumbing Fixtures
 - 8. 232113 - Hydronic Piping and Specialties
 - 9. 233100 - Ducts and Accessories
 - 10. 233600 - Air Terminal Units
 - 11. 233700 - Air Outlets and Inlets

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. MSS SP58-2018 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- B. Abbreviations, Acronyms and Definitions:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.

1.3 DESCRIPTION

- A. Design Requirements:
 - 1. Equipment and piping system support:
 - a. Select and apply pipe hangers and supports per MSS SP58 using stock or production parts whenever possible.
 - b. Design support spacing such that free span of piping does not exceed Code or MSS SP58 criteria (whichever is most restrictive).
 - c. Calculate required supporting force at each hanger location to confirm hanger type and hanger rod diameter selection.

- d. Provide hangers such that equipment connection points do not carry connected piping load.
 2. Vibration and seismic restraint systems: Coordinate the requirements of this section with Section 200548 - Mechanical Vibration and Seismic Control.
- B. Performance Requirements:
1. Provide hangers and supports which allow for the free expansion and contraction of system piping without transferring tensile and compressive stresses to adjacent supports or connected equipment. Provide additional expansion loops, pipe anchor and pipe guide assemblies as required.
 2. Coordinate hanger and support anchor locations and embedment depth requirements with structural.
 3. Provide flexible connectors for piping systems which pass through seismic building joints. Design flexible connects for design building offset plus 100 percent safety factor.
 4. Support fire suppression system piping and equipment accordance with the provisions of Section 211000 - Water Based Fire Suppression Systems.
 5. Support plumbing piping in accordance with this section and Uniform Plumbing Code requirements; whichever is more restrictive. In case of conflicts, follow UPC guidance.
 6. Support ductwork in accordance with Section 233100 - Ducts and Accessories.
 7. Special Performance Requirements for Open Ceiling Spaces:
 - a. Coordinate the support of piping, ductwork, lighting, and electrical cabling in open ceiling spaces (utilizing the shop drawing review process) to provide a uniform and symmetrical appearance.
 - b. In general, utilize trapeze hanger style support systems with hangers equally spaced based on the limiting component being supported. Provide hanger rods vertical and straight. Trim hanger rod ends to provide a “finished” appearance.
- 1.4 PRE-INSTALLATION MEETINGS
- A. See section 200000 - Mechanical General Requirements.
- 1.5 SUBMITTALS
- A. See Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data:
1. Provide manufacturers catalog data, including load capacity, embedment depth.
 2. Manufacturer’s Installation Instructions: Indicate special procedures and assembly of components.
- C. Shop Drawings:
1. Provide shop drawings for housekeeping pads and roof curbs (with dimensioned penetrations) and field fabricated support systems.
 2. Provide shop drawings to show system layout with location and detail of hangers, anchors, dimensioned expansion loops and guides. Coordinated with Section 200548 - Vibration and Seismic Control shop drawing submittal.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance (IO&M) Manuals:
 - 1. Refer to Section 200000 - Mechanical General Requirements, for IO&M Manual formatting requirements and number of copies required.
 - 2. Include the following:
 - a. Copies of approved submittal information.
 - b. Manufacturer's installation, operating and maintenance/repair instructions, parts listings, and spare parts list for each product. Clearly annotate the manual to indicate applicable information for the specific equipment model(s) installed.
- B. Warranty Documentation: Provide standard manufacturer's warranty and submit documentation in accordance with Section 200000.
- C. Record Documentation:
 - 1. Indicate installed locations of hangers, supports and expansion control assemblies on record drawings on associated piping record drawings.
 - 2. Provide Operating and Maintenance Data (installation and adjustment instructions) for non-commodity products.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.
- B. Provide piping and support systems designed and manufactured per MSS SP58.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.10 WARRANTY

- A. See section 200000 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. General:
 - 1. Piping and support systems shall be malleable iron, steel, or copper.
 - 2. Ferrous hangers and supports installed outdoors or in unheated spaces shall be hot dipped galvanized.
 - 3. Select and apply pipe hangers and supports per MSS SP58.
 - a. Use stock or production parts whenever possible.
 - b. Calculate weight balance to determine the required supporting force at each hanger location and to eliminate pipe weight load at each equipment connection.

4. Fabricate and install pipe hangers and supports per MSS SP58 recommended practices.
5. Hangers shall be designed to securely lock using a mechanical fastener. Hangers and supports using gravity type locking are not acceptable. For example, adjustable swivel ring Type 6 is not allowed.
6. Pre-engineered support systems such as Unistrut, Super-Strut, B-Line and K-Line may be used in accordance with manufacturers load limits.
7. Manufacturers: Grinnell, M-CO Michigan Hanger Company, Kin Line.

B. Plumbing Piping:

1. Conform to the Uniform Plumbing Code requirements.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Adjustable swivel ring; split ring.
3. Hangers for DWV and Cold Pipe Sizes two inch and over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe sizes two to four inch: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes six inches and over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers under six inches: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes six inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Supports: Welded steel bracket and wrought steel clamp.
9. Wall Support for Hot Pipe Sizes six inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
11. Floor Support for Hot Pipe Sizes up to four inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
12. Floor Support for Hot Pipe Sizes six inches and over: Adjustable cast iron roll and stand, steel screws, and steel support.
13. Vertical Support: Steel riser clamp.
14. Provide copper plated hangers and supports for copper piping. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Hydronic Piping:

1. Conform to ASME B31.9 and the International Mechanical Code.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Adjustable swivel ring; split ring.
3. Hangers for Cold Pipe Sizes two inches and over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe sizes two to four inch: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe sizes six inches and over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes six inches and over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support: Welded steel bracket and wrought steel clamp.
9. Wall Support for Hot Pipe Sizes six inches and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
12. Floor Support for Hot Pipe Sizes up to four inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.

13. Floor Support for Hot Pipe Sizes six inches and over: Adjustable cast iron roll and stand, steel screws, and steel support.
14. Provide copper plated hangers and supports for copper piping. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Refrigerant Piping:

1. Conform to ASME B31.5.
2. Hangers for pipe sizes 1/2 to 1-1/2 inch: Adjustable swivel ring, split ring.
3. Hangers for pipe sizes two inches and over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
8. Provide copper plated hangers and supports for copper piping. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel, threaded both ends, threaded one end, or continuous threaded.
- B. Escutcheons: Nickel or chrome plate with screws or springs for holding plate in position.
- C. Pipe Protection Saddles: Shop fabricated, or purchase specially manufactured saddles specifically designed for the intended use. Provide saddles where roller type support is used, or where the pipe hanger is installed outside the insulation for protection of insulating jacket.
- D. Outdoor applications: Metal components shall be galvanized.

2.3 PRE-ENGINEERED SUPPORT SYSTEMS

A. Manufacturers:

1. Unistrut.
2. Super-Strut.
3. B-Line.
4. K-Line.
5. Erico.

B. Materials:

1. Cold worked steel.
2. Type 304 stainless steel: Use for PVC, liquid-tight flex, or plastic-coated conduit installed to wood construction in outdoor, damp, corrosive or marine environments.

C. Finish:

1. Heated indoor areas: Pre-galvanized zinc coating.
2. Outdoor areas: Hot dipped galvanized finish. In addition, coat hot dipped galvanized finish channel field cuts with zinc rich paint provide by the support system manufacturer.
3. Painted areas: Paintable galvanizing or phosphatized and primed.
4. Surface metal raceways: U.L. Listed epoxy coating.

- D. Channel:
 - 1. Standard Size: 1-5/8 inch x 1-5/8 inch. Gauge thickness as required for attached load.
 - 2. Standard Hole Pattern: Slotted. Provide solid channel in exposed public areas.
- E. Nuts and Hardware:
 - 1. Channel nuts: Hardened steel (ASTM-A675 and ASTM A36).
 - 2. Bolts, screws and nuts: Hardened steel (ASTM-A307, ASTM A563 and SAE J429).
 - 3. Finish: Electroplated zinc.
- F. Fittings: Plate steel (ASTM A635). Epoxy or electroplated zinc coating.
- G. Mechanical Accessories: Provide accessories from the support system manufacturer designed for the specific equipment to be supported to include but not limited to:
 - 1. Splice and gusset plates.
 - 2. Corner angles.
 - 3. Specialized support brackets.
 - 4. Beam clamps with restraints.
 - 5. Column supports.
 - 6. Strut pipe clamps.
 - 7. Straps.
 - 8. Brackets.

2.4 PIPING ROOF SUPPORTS (NON-PENETRATING)

- A. Manufacturers:
 - 1. Cooper Industries (Dura-Blok).
 - 2. Miro Industries, Inc.
 - 3. Pipe Pier.
- B. Resilient, non-abrasive, UV resistant base. Galvanized steel channel and clamps. Zinc plated, adjustable hardware. Compatible with roof system.
- C. Roof supports shall be provided to maintain piping a minimum of 3-1/2 inches above the roof surface.

2.5 SLEEVES, ACOUSTICAL SEALS AND FIRE-STOPPING

- A. See Part 3 - PENETRATIONS.
- B. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing: UL listed prefabricated fire rated sleeves and seals.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Installer: Perform work by experienced personnel previously engaged in construction and under the supervision of a qualified installation supervisor.

3.2 PREPARATION

- A. Prior to installation, prepare detailed shop drawings of the planned installation of hanger and support products specified by this section. Coordinate the location, type and size of hangers and supports, housekeeping pads (thickness/perimeter overhang dimensions) and roof curbs with Architectural and Structural elements utilizing the shop drawing review process.
- B. Submit shop drawings required by this section coordinated with the seismic design and associated shop drawings required by Section 200548 – Mechanical Vibration and Seismic Control as a single submittal.
- C. Do not install hangers and supports without approved shop drawings.
- D. Protection of In-Place Conditions: Caution - Project contains cast in place radiant floor heating and snow-melting tubing at main entry vestibule, main entry sidewalks, and parking garage alleyway/driveway. Coordinate slab penetration locations so as not to damage tubing.

3.3 INSTALLATION

- A. Special Techniques:
 - 1. Install vibration isolators, seismic control, and wind restraint systems in compliance with the manufacturer's written instructions and certified and approved application engineering installation drawings and details in accordance with Section 200548 - Mechanical Vibration and Seismic Control.
 - 2. Insert and Attachment Installation:
 - a. Inserts:
 - 1). Provide inserts or cast-in-place channels for placement in concrete formwork.
 - 2). Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3). Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 4). Use expansion type anchor bolts with pre-cast concrete including concrete masonry units within loading limits of the pre-cast material and anchor bolt manufacturer's recommendations.
 - 5). Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
 - 6). Plastic screw inserts and caulked lead inserts are prohibited, except for mounting instructions and control diagrams.
 - b. Attach mechanical equipment to structure as follows:
 - 1). Hollow masonry: Toggle bolts.
 - 2). Solid masonry and concrete: Preset inserts or expansion bolts.
 - 3). Structural steel: Beam clamps which engage both sides of structural member or have retaining clips or other approved means for positive engagement.
 - 4). Metal surfaces: Machine screws, bolts, or welding.
 - 5). Wood construction: Wood or sheet metal screws.
 - 6). Do not use powder-actuated fasteners for anchorage in tension applications. Obtain written permission from the Owner prior to using any type of powder powered studs.

3. Pipe Hanger and Support Installation:
 - a. Install hangers and supports in accordance with manufacturer's instructions, applicable Code requirements and approved shop drawings.
 - b. Support horizontal piping as scheduled.
 - c. Independently support piping at equipment, so that the equipment supports no weight.
 - d. Insulated piping shall have insulation saddles or 18 gauge steel insulation shields combined with sections of calcium silicate or cellular glass. Cold piping shall always be supported over the insulation and vapor barrier. Subject to approval, hot piping may be insulated around the supports.
 - e. Trapeze hangers shall be used when more than three pipes run parallel and at same elevation. Provide rollers for hot pipes. Design rods and cross members to support three times the weight of pipes and contents plus 250 pounds.
 - f. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - g. Place hangers within 12 inches of each horizontal elbow.
 - h. Use hangers with 1-1/2 inch minimum vertical adjustment.
 - i. Support horizontal cast iron pipe adjacent to each hub, with five feet maximum spacing between hangers.
 - j. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
 - k. Support riser piping independently of connected horizontal piping.
 - l. Provide saddles where roller type support is used, or where the pipe hanger is installed outside insulation for protection of insulating jacket.
 - m. Piping requiring Vibration Isolation:
 - 1). Coordinate with Section 200548 – Mechanical Vibration and Seismic Control for piping requiring vibration isolation.
 - 2). Support main risers less than 20 feet in height only at mid-level, with riser guides at other levels.
 - 3). Do not support vibration isolated piping along with non-isolated piping on a common trapeze.
 - 4). Rigidly mount steel spring hanger boxes to the supporting structure. Do not locate in the middle of the hanger rod.
 - 5). Rigid pipe anchors are not permitted in vibration isolated piping circuits. When pipe anchors are required.
4. Equipment Bases and Support Installation:
 - a. For cast-in-place concrete requirements refer to Division 3 - Concrete.
 - b. Provide minimum 3-1/2 inch (2x4 form) concrete housekeeping pads for floor mounted mechanical equipment. Coordinate perimeter overhang dimensional requirements (8 inches typical) with Section 200548 - Mechanical Vibration and Seismic Control, such that equipment anchor bolts achieve proper embedment.
 - c. Construct field fabricated equipment bases and supports from steel members and/or pre-engineered support systems. Prime and paint bases and supports black in accordance with Division 9 - Finishes. Pre-engineered support systems which are factory coated are not required to be painted.
5. Roof Curb Installation:
 - a. Coordinate with Architectural and provide roof curb locations and dimensional and support requirements for roof mounted equipment.

6. Mechanical Equipment Installation:
 - a. Provide hardware and accessories necessary to mount fixtures and equipment. Adapt to field conditions.
 - b. Securely fasten fixtures and equipment to the building structure in accordance with the manufacturer's installation recommendations.
 - c. Provide fabricated steel supports frames and bases for equipment not directly mounted on floor. For belt driven equipment provide rigid structural base in common with motor to maintain belt tension.
 - d. Provide steel base plates for floor mounted fixtures and equipment to distribute the weight such that the floor load is not more than 100 PSF, unless special structural reinforcement is submitted for approval.
 - e. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates at least 1/8 by 10 inch square sheet steel or two by 10 inch fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.
 - f. Painted fabricated steel support black in accordance with Division 9 - Finishes.
7. Penetrations:
 - a. Coordinate mechanical penetrations with architectural and structural construction details prior to installation. Set sleeves in position in concrete formwork. Provide reinforcement around sleeves as required.
 - b. Provide compatible materials, fasteners, adhesives, sealants, and other products required for proper installation.
 - c. Provide penetrations through roof, exterior walls, and floors (See floor penetration seals) to be weather and watertight.
 - d. Fire-Stopping: Provide UL rated fire-stopping assemblies for rated roof, wall and floor penetrations in accordance with Division 7.
 - e. Pipe and Duct Sleeves/Framed Openings:
 - 1). Provide sleeves for pipe and round ducts less than 16 inches diameter passing through floors, walls, ceilings, or roofs. Fabricate sleeves in non-load bearing walls from 20 gauge galvanized sheet steel conforming to ASTM A924 / A924M. Fabricate sleeves in load-bearing walls from standard-weight galvanized steel pipe conforming to ASTM A53 / A53M. Provide 1 inch clearance between the pipe or duct and sleeve opening. Oversize sleeves for cold piping to allow continuous insulation through sleeve.
 - 2). Provide framed openings for round ducts 16 inch diameter and greater and rectangular ductwork passing through floors, walls, ceilings, or roofs. Provide structural steel members for framed openings conforming to ASTM A36 / A36M. Provide 1 inch clearance between the duct and framed opening.
 - 3). Provide closure collars not less than 4 inches wide on each side of duct wall or floor penetration where sleeves or framed openings are provided. Fabricate collars for round and rectangular ducts with a minimum dimension less than 16 inches from 20 gauge galvanized steel. Fabricate collars for round and rectangular ducts with a minimum dimension of 16 inches or greater from 18 gauge galvanized steel.
 - 4). Provide escutcheons for piping and conduit passing through walls, floors and ceilings in finished areas, below counters and inside closets and casework subject to view when doors are open. Size escutcheons to cover sleeves. Secure escutcheons in position.

- f. Acoustical Seals:
 - 1). Monolithic sound walls (i.e. poured concrete or masonry): Provide wall sleeve with approximately one-inch annular space around pipe. Pack annular space with backer rod or acoustical filler as specified in Division 7. Allow a 1 inch recess at each end of sleeve. Caulk sleeve flush with flexible sealant or firestopping material as specified in Division 7.
 - 2). Where acoustical wall is a two component type, such as a staggered or double stud partition, treat each component as a separate wall. Pack and seal each half of penetration sleeve as previously specified, except that only the exposed end of each sleeve portion can be caulked with sealant or fire-stop. Provide adequate separation between each sleeve.
 - g. Wall Penetration Seals:
 - 1). Provide pre-engineered wall penetration water seal systems for exterior wall penetrations.
 - 2). Select appropriate wall penetration sealing systems based on pipe/conduit material and nominal pipe/conduit size in accordance with the manufacturer's selection charts.
 - 3). Install piping/conduit and sealing system prior to waterproofing the wall. Grout void between water seal and outside face of foundation wall to provide continuous bearing surface for waterproofing fabric.
 - h. Floor Penetration Seals:
 - 1). Provide pre-engineered floor penetration water seal systems for floor penetrations in rooms where a pipe leak/failure could result in water damage to adjacent spaces (i.e. mechanical rooms located above the ground floor or basement) and other areas as noted.
 - 2). Floor penetrations to include but not limited to: Building service piping, conduit, ductwork and building automation system wiring.
 - 3). Extend floor penetration sleeves 2 inches above finished floor.
 - 8. Roof Flashing: Provide EDPM pipe penetration and roof curb flashing in accordance with Section 075000 - Single-Ply EDPM Membrane Roofing, as an integral part of the roofing system.
- B. Interface with Other Work: Coordinate and sequence installation of hangers and supports with trades responsible for portions of this and other related sections of the Project Manual.

3.4 REPAIR/RESTORATION

- A. Repair any product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.

3.5 SITE QUALITY CONTROL

- A. Non-Conforming Work: Rework required as a result of failure to follow the manufacturer's written installation instructions or to properly coordinate with related Work shall be completed at no additional expense to the Owner.

3.6 CLEANING

- A. Waste Management: After construction is completed, clean and wipe down exposed surfaces.

3.7 ATTACHMENTS

A. Tables:

1. Pipe Support: Provide pipe support spacing as indicated in the table below, except where spacing is more restrictive by Code.

PIPE SIZE (Inches)	HANGER SPACING MAX (Feet)			
	Steel		Copper	Polyethylene (1)
	Water Filled	Gas Filled		
1/2	7	9	5	
3/4	7	9	5	
1	7	9	6	
1-1/4	7	9	7	
1-1/2	9	12	8	4
2	10	13	8	4-1/2
2-1/2	11	14	9	
3	12	15	10	5
4	14	17	12	6
6	17	21	14	
8	19	24	16	

(Based on Table 4, MSS SP-58, except for PE piping)

(1)(Based on manufacturer's data)

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section specifies performance requirements for the design, furnishes, installation, supervision, and administration for all aspects of thermal expansion and contraction, vibration isolation, and seismic control of mechanical and electrical non-structural elements of the Project as shown on the drawings and/or specified in this and other Divisions for this non-essential facility. This is substantially a "performance" specification, unless otherwise noted.
2. It is the design intent to seismically anchor, brace, and support the facility's non-structural elements, including pre-engineered equipment, to the building's structure as required by the International Building Code (IBC). Seismic restraint is required for life safety and high hazard mechanical and electrical equipment and systems for this non-essential facility.
3. All seismic submittals, permits, and inspections required by the Authority Having Jurisdiction (AHJ) shall be included.

B. Design Requirements:

1. Obtain the services of a specialized and qualified design firm (Seismic Design Firm) to design the overall vibration and seismic control restraint systems for the non-structural mechanical and electrical elements of this Project in accordance with the International Building Code (IBC) chapters 16 and 17.
2. Duties of the Seismic Design Firm include:
 - a. Specialized design and product selection.
 - b. Site verification and written certification that the installed vibration and seismic control products and systems meet the specialized design requirements.
3. Exceptions.
 - a. Pre-engineered seismically designed and certified assemblies in accordance with IBC, accompanied with written "Certificate of Compliance" acceptable to the Authority Having Jurisdiction, AHJ. Example: lay-in ceiling system assemblies.
 - b. Pre-manufactured equipment designed in accordance with IBC accompanied with written "Certificate of Compliance" acceptable to the Authority Having Jurisdiction.

C. Related Divisions and Sections:

1. Divisions 20, 21, 22, 23, 25 - Mechanical
2. Divisions 26, 27 and 28 - Electrical

1.2 REFERENCES

A. Perform work in accordance with the legally enacted editions and amendments of the following codes and standards:

1. International Fire Code – 2021, IFC.
2. International Mechanical Code – 2021, IMC.
3. International Building Code – 2021, IBC.
4. Uniform Plumbing Code – 2018, UPC.
5. ASCE 7–16, Minimum Design Loads for Buildings and Other Structures.
6. NFPA 70 – 2020, National Electric Code, NEC.

7. NFPA 101 – 2018, Life Safety Code.
- B. Provide materials, equipment, and installation methods which comply with the current standards of the following trade organizations:
1. American Society of Heating Refrigerating and Air Conditioning Engineers – ASHRAE.
 2. American Society of Mechanical Engineers – ASME.
 3. Federal Emergency Management Agency – FEMA:
 - a. Installation of Seismic Restraints for Mechanical Equipment FEMA 412.
 - b. Installation of Seismic Restraints for Electrical Equipment FEMA 413.
 - c. Installation of Seismic Restraints for Duct and Pipe FEMA 414.
 4. Underwriters Laboratories – UL.
 5. VISCMA – Vibration Isolation and Seismic Controls Manufacturers Association.

1.3 RELATED WORK

- A. Coordinate with mechanical Section 200529 Hangers and Supports and electrical Section 200529 Hangers and Supports, for related items of work and requirements.

1.4 SYSTEM DESCRIPTION AND CRITERIA

- A. Design Requirements:
1. Provide vibration isolation and seismic control anchoring and support system products and application design and installation supervision services from an approved product manufacturer and a Seismic Design Firm.
 2. Provide design to anchor, brace, and support the facility's non-structural elements, including pre-engineered equipment, to the building's structure. Provide all secondary structural elements to support, anchor, and transfer loads to the building structure. This includes mechanical and electrical equipment, tanks and vessels, system piping, and electrical raceways.
- B. Building Design Data:
1. Wind design data: See Structural Drawings.
 2. Seismic design data: Seismic Design Category D, see Structural Drawings.
 3. Seismic Component Importance Factors, I_p :
 - a. Life Safety Components, including fire suppression systems: $I_p = 1.5$
 - b. Components containing hazardous materials, including fuel gas systems and equipment: $I_p = 1.5$
 - c. Piping Importance Factor: $I_p = 1.0$
 - d. All other components: $I_p = 1.0$
- C. Performance Requirements:
1. Design seismic restraint devices to accept the detailed forces acting through the equipment's center of gravity for the non-structural components of the project.
 2. Responsibilities of the Seismic Design Firm include:
 - a. Professional engineering calculations, drawings, and details to show the restraint of non-isolated equipment.
 - b. Determination of vibration isolation and restraint product sizes and locations.
 - c. Provision of installation instructions, detailed shop drawings, and trained field supervision to ensure proper installation and performance for work under this Section.

- d. Review and approval or rejection of Certificates of Compliance from Original Equipment Manufacturers (OEM) furnishing seismically designed pre-engineered equipment or assemblies.
- e. Certification of the correctness of installation upon completion.

1.5 VIBRATION AND SEISMIC CONTROL DESIGN

A. Seismic and Wind Load Certification and Analysis:

1. Prepare and submit professional engineering sealed calculations, drawings, and details substantiating the mounting system, seismic and/or wind restraints, and recommended anchor bolts for each piece of mechanical and electrical equipment will accept anchorage, through the component's load path to structure at its center of gravity, at the designated anchorage locations. Details and calculations shall include attachment to building structure or exterior pad. Show evidence of coordination with the structural engineer of record.
2. Calculations and supporting documents to clearly show assumptions, materials, dimensions, abbreviations, code references and formulas, force diagrams, and results intermediate steps to validate conclusions without the use of a computer program by the reviewer.
3. Design seismic loads.
4. Design wind loads.
5. Engineering calculations, drawings, and details, and product information shall be submitted to and approved by the Authority Having Jurisdiction.

B. Design Seismic Loads:

1. Minimum design load:
 - a. Calculate loads for both internal or external isolation and/or anchorage of components for the actual project location but not less than:
 - 1). 0.4g for statically mounted components.
 - 2). 0.5g for resiliently mounted components.
2. Minimum horizontal restraint capability:
 - a. 0.4g horizontal.
 - b. 0.9g horizontal (Life Safety equipment and High Hazards).
 - c. 0.27g vertical.
 - d. 0.6g horizontal (Life Safety equipment and High Hazards).
3. Minimum vertical load: Calculate at 1/3 the horizontal load.
4. Analysis for anchorage to include:
 - a. Calculated dead loads.
 - b. Static seismic loads.
 - c. Material strength of anchoring material (system).
 - d. Load transfer to adequate structural members.
 - e. Detail of anchoring methods including:
 - 1). Bolt diameter.
 - 2). Embedment and/or welded depth, length, and type.

C. Design Wind Loads:

1. Positively fasten outdoor mounted components to their supporting structure(s) to prevent failure due to wind load.
2. If equipment is mounted to a pre-engineered or field fabricated support bracket, provide positive attachment through welding or bolting of equipment to the support system:
 - a. Base loads and calculations on IBC and related ASCE 7 sections.

- b. Base equivalent basic wind speed on IBC.
- c. Do not de-rate calculated wind load on outdoor equipment due to adjacent buildings, structures or screens.

1.6 SUBMITTALS

- A. Refer to Division 1 for general submittal, closeout submittal and product substitution requirements.

1.7 QUALITY ASSURANCE

- A. Manufacturer qualifications: Company specializing in manufacturing the products specified in this section with a minimum of five years documented experience.
- B. Installers' qualifications: Minimum five years' experience in the installation of specialized vibration and seismic control systems.
- C. Seismic Design Firm: Minimum five years' experience in the design, selection, and inspection of specialized seismic control systems for facilities with similar Occupancies and seismic criteria and acceptable to the Authority Having Jurisdiction. Liability insurance and professional Errors and Omissions insurance for engineering services provided.
- D. Seismic Design Engineer: Alaska licensed professional engineer with advance formal education and training in structural engineering relating to seismic design. Engineer shall have a minimum of 5 years of documented seismic engineering experience and acceptable to the Contracting Agency and the Authority Having Jurisdiction.
- E. Errors and Omissions Insurance Certificate: Submit copy of seismic design firm's insurance certificates.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site:
 - 1. Verify vibration isolator/seismic restraint components are delivered in original factory packaging/crating and are free from damage and corrosion.
 - 2. Replace equipment delivered to job site that does not comply with above requirements at no expense to the Contracting Agency.
- B. Storage and Protection:
 - 1. Store products in covered storage area, protected from the elements, outside the general construction area until installed.
 - 2. Handle items to avoid damage.
 - 3. Replace damaged items with same item in new condition.

1.9 WARRANTY

- A. Refer to Division 1 for warranty requirements.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Materials and devices shall be in accordance with applicable codes and standards and shall be appropriate for intend uses.

2.2 MANUFACTURERS

- A. Approved Manufacturers, substitutions by prior approval only. Subject to compliance with requirements, provide products by one of the named manufacturers.
 1. Amber Booth (AB).
 2. Cooper B-Line.
 3. Flex Hose.
 4. Hilti.
 5. International Seismic Application Technology (ISAT).
 6. Kinetics Noise Control.
 7. Korfund Dynamics.
 8. Loose & Company.
 9. Mason Industries.
 10. Metraflex.
 11. Tolco.
 12. Unistrut, Tyco International.
 13. Vibration Mountings & Controls (VMC).
 14. Vibro-Acoustics.
 15. Other: Pre-approved.

2.3 PRODUCT CATEGORIES

- A. Provide product submittals in the following categories with specific product and application identified:
 1. Vibration Isolation.
 2. Seismic Restraint.
 3. Equipment Bases and Curbs.
 4. Flexible Connectors

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Visually inspect each location that will receive equipment and systems requiring vibration, thermal compensation, seismic control and/or wind load bracing for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and pre-placed anchors to verify actual locations before installation.
- C. Correct deficiencies prior to the installation.

3.2 FINISHES

- A. Provide finishes for corrosion protection:
 - 1. Exposed steel to be finished with dry powder coating for corrosion protection, galvanized, or stainless steel.
 - 2. Hardware shall be zinc electroplated, galvanized, or stainless steel. Hardware in contact with cement and surfaces subject to liquids shall be stainless steel.
 - 3. Springs and housings shall be powder coated.
- B. In public areas, exposed systems and elements shall be painted, excluding dynamic assemblies that shall have manufacturer's coating.

3.3 GENERAL INSTALLATION REQUIREMENTS FOR VIBRATION ISOLATION, SEISMIC CONTROL, AND WIND RESTRAINT SYSTEM COMPONENTS

- A. Install vibration isolators, seismic control, and wind restraint systems in compliance with the manufacturer's written instructions, and certified and approved application engineering installation details.
- B. Install vibration isolators, seismic control, and wind restraints so as not to stress or misalign equipment, piping, raceways, and ductwork.
- C. Provide flexible connections for conduit, ducts, and piping for vibration isolated equipment.
- D. Coordinate installation of ducts, pipes, and raceways to not degrade acoustical penetrations and vibration controls.
- E. Do not install rigid connections between isolated equipment and building structure that degrades the noise and vibration control system.
- F. Submit equipment loads for pre-approval by the Project Structural Engineer prior to equipment installation to avoid overstressing of the building structure. Coordinate seismic restraints with Project Structural Engineer and incorporate requirements.
- G. Seismic restraint systems shall not interfere with installation or maintenance access to other building systems.
- H. Provide general bracing from structural beam flanges, upper truss cords in bar joist construction, cast in place inserts, or wedge type anchors.
- I. Restraining straps or J-bolts shall be used as secondary restraint on beam clamps that support dead loads. Beam claps lacking secondary restraint features shall not be used.
- J. Install seismic cable assemblies taut on non-vibration isolated systems and with a slight amount of slack for vibration isolated systems to avoid short circuiting of isolated equipment and piping.
- K. Seismic single arm braces may be used in place of cables on rigidly attached systems and in place of cables on isolated systems when resilient bushings are used.

- L. At locations where seismic cable restraints or seismic single arm braces are located, brace support rods when necessary to accept compressive loads.
- M. At locations where seismic cable braces and seismic cable restraints are attached to pipe clevis hangers, reinforce the clevis hanger bolt with cross bolt braces or double inside nuts if required for the specific seismic acceleration levels.
- N. Provide integral vibration isolation structural steel bases when required. Independent steel rails are not permitted.
- O. Conduct Special and Periodic Inspections and submit reports in a timely basis; a maximum of 2 working days between site inspection and receipt of written report.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections or design accommodations in pipes, ducts, and raceways where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 INSTALLATION OF EQUIPMENT

- A. Isolate and/or restraint equipment in accordance with manufacturer's recommendations.
- B. Install equipment bases into position (at operating height of the isolators) using temporarily support blocks or shims prior to the installation of the equipment, isolators and restraints.
 - 1. After the installation is complete and under full load (i.e. equipment filled with operating fluid), adjust isolators to transfer load from the temporary blocks to the isolators.
 - 2. Remove blocks, shims and debris from beneath the equipment and verify that there are no short circuits of isolation. Verify the equipment is free move in all directions, within the limits of the restraints.
- C. Restrain floor and wall mounted equipment and tanks.

3.6 INSTALLATION OF PIPING, AND DUCTWORK, ELECTRICAL VIBRATION ISOLATION

- A. Provide flexible connections for conduit, raceways, ducts, and piping for vibration isolated and other equipment requiring isolation.
- B. HVAC Liquid Piping: vibration isolation is not required, unless indicated otherwise.
- C. HVAC Ductwork: vibration isolation is not required, unless indicated otherwise. Provide flexible connections to isolated equipment.
- D. Fire suppression: vibration isolation is not required, unless indicated otherwise.

3.7 INSTALLATION OF PIPING, DUCTWORK, AND ELECTRICAL SEISMIC RESTRAINT

- A. Seismic restraint is not required for mechanical and electrical components in Seismic Design Category D where component importance factor, I_p , is equal to 1.0 and either:

1. Flexible connections between the components and associated ductwork, piping, and conduit are provided.
 2. Components are mounted at 4 feet or less above a floor level and weigh 400 pounds or less.
- B. High Hazard and Life Safety Systems; component importance factor; I_p , is equal to 1.5.
1. Seismically restrain High Hazard and Life Safety Systems regardless of piping diameter, etc. No exclusions for size or distance in this category.
 2. High Hazard and Life Safety Piping Systems to include:
 - a. Any fixed tanks or piping containing hazardous, flammable, combustible, toxic, or corrosive materials, which include fuel gas, fuel oil, and gasoline.
 - b. Fire suppression mains and risers.
 - c. Flammable, oxidizing, oxygen depletion, and/or combustible gases and fluids which shall be contained within a closed system (i.e. any gases which pose a health hazard if released into the environment are High Hazard).
 - d. Electrical: Critical, standby or emergency power components including conduit (1 inch diameter and larger) cable trays and bus duct, lighting, fire alarms, panels and communication lines involving 911, etc.
 - e. Ductwork: Fuel fired breeching and stacks, toxics, and flammable gases.
 3. For vibration isolated piping systems, provide slightly slacked seismic cable restraints or resilient single arm braces.
 4. For non-isolated piping, provide tight seismic cable restraints or single arm braces.

3.8 CONSTRUCTION

- A. Interface with other Work:
1. Coordinate and sequence installation of vibration, seismic control and wind load bracing with trades responsible for portions of this and other related sections of the Project Manual.
 2. Rework required because of failure to follow the manufacturer's written installation instructions or properly coordinate with related Work shall be completed at no additional expense to the Contracting Agency.
 3. Coordinate and schedule special inspections related to systems under this specification section.

3.9 REPAIR/RESTORATION

- A. Repair product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.

3.10 FIELD QUALITY CONTROL

- A. Document each installation and operational step to show compliance with this Section.
- B. Manufacturer's Field Services:
1. Upon completion of installation of all vibration isolation/seismic restraint devices and systems, the vibration isolator/seismic restraint manufacturer's qualified representative shall inspect the completed project and certify in writing to the Contractor that all systems are installed properly or provide detailed corrective action required.

2. If corrections are required, additional inspections shall be completed by the manufacturer's representative until all the work is installed properly and certified.
 3. The Contractor shall submit a report to the Contracting Agency that includes the manufacturer's qualified representative letter certifying correctness of the installation.
- C. Seismic Design Firm:
1. Site verification and written certification installation is per submitted documents and completed.
 2. Include photo of completed installation of equipment with tag ID annotated installed isolators and restraints, and typical installation with location annotated.
- 3.11 CLEANING
- A. Upon completion of installation remove construction debris from around vibration isolated and seismically restrained components to allow free motion in all directions within the limits of the seismic restraining devices.
- 3.12 EQUIPMENT STARTUP
- A. During equipment start-up, verify proper installation and operation of associated vibration isolators and seismic restraints as applicable.
- 3.13 ADJUSTING
- A. Adjust isolators after piping system is at operating weight.
 - B. Adjust active height of spring isolators.
 - C. Adjust restraints to permit free movement of equipment within normal mode of operation.
 - D. Adjust vibration isolators and seismic restraints as required during equipment operation to minimize the transmission of equipment sound and vibration through the building structure and attached ductwork and piping systems.
 - E. Allow for thermal compensation

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Equipment Nameplates.
 - 2. Valve Tags.
 - 3. Valve and Equipment Directories.
 - 4. Pipe Identification.
 - 5. Ceiling Markers.

- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 221100 - Domestic Water Piping and Specialties
 - 3. 221300 - Sanitary Waste and Vent Piping and Specialties
 - 4. 232113 - Hydronic Piping and Specialties
 - 5. 233100 - Ducts and Accessories
 - 6. 233600 - Air Terminal Units

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. ANSI/ASME A13.1-2015 (American Society of Mechanical Engineers) - Scheme for the Identification of Piping Systems.
 - 3. ANSI Z535.1-2017 - Safety Colors.

- B. Abbreviations, Acronyms and Definitions:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide equipment nameplates, valve tags and labels for the mechanical systems provided under this contract.
 - 2. Provide labels for piping.

1.4 SUBMITTALS

- A. Refer to Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.

- B. Product Data:
 - 1. Master Schedule of Equipment:
 - a. Submit master schedule of equipment, components, and systems that will be tagged and labeled for the project.

- b. Include the proposed method of labeling to be implemented (nameplate, tag, label/marker, etc.), legend (“Domestic Cold Water,” “PMP-1,” etc.) and letter/background colors.
- c. Match legend to Contract Document legend, abbreviations, and schedule symbols. Use standard mechanical identification products when available.
- 2. Equipment Directories: Submit separate proposed “Equipment Directories” (subset of the master schedule) for each mechanical room that includes the equipment located within the applicable space. Include system name, fluid or medium type, and normal operating properties and ranges.
- 3. Valve Directories: Submit separate proposed “Valve Directories” (subset of the master schedule) for each mechanical room that includes the valves located within the applicable space. Include valve designations, a brief description and normal position (open (NO), closed (NC), balanced to X GPM). For Example:

Valve Designator	Description	Normal Position
H-101	BLR-1 Supply Isolation	NO
H-102	BLR-1 Return Isolation	NO
H-103	BLR-1 Flow Balance	150 GPM
P-100	Domestic Water Service Isolation	NO
P-201	Supply Strainer Flush Valve	NC
ETC.		

- C. Installation, Operation and Maintenance (IO&M) Manuals:
 - 1. Provide completed, typed “Master Schedule of Equipment.”
 - 2. Provide completed, typed “Equipment Directories.”
 - 3. Provide completed, typed “Valve Directories” with balance valve settings obtained from the final balance report.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Marking Services Incorporated (MSI).
- B. Seton Identification Products.
- C. Craftmark.
- D. Approved equal.

2.2 EQUIPMENT NAMEPLATES

- A. Plastic Engraved Equipment Nameplates:
 - 1. Minimum letter height: 3/4 inch.
 - 2. Tag size: Minimum 2 inches high, length to fit equipment tag lettering requirements. Provide uniform size for similar types of equipment.
 - 3. Plastic thickness: 1/16 inch minimum.

4. Fastening method:
 - a. Mounting holes.
 - b. Adhesive backing may be provided for labeling equipment where drilling holes is not feasible, with the pre-approval of the Contracting Agency.
5. Color coding: As designated by the Contracting Agency. If specific direction is not provided, select white letters on black background.
6. Legend: As designated by the Contracting Agency. If specific direction not provided, match scheduled equipment symbols.

2.3 VALVE TAGS

A. General:

1. Small equipment, such as in-line pumps may be identified with tags in lieu of nameplates if inadequate room is available.
2. Provide service indicator on top line of tag, using system abbreviations provided in Part 3 Pipe Identification Table.
3. Provide valve number on bottom line of tag. Start valve numbering with "001" for each legend series/service indicator. Assign valve numbers in a logical sequence from the source (i.e. service water entry point, gas meter service isolation) or heat source (boiler or water heater supply) and continue numbering outward to the most remote terminal connection point.

B. Plastic Engraved Tags:

1. Round, 1-1/2 inches diameter, engraved plastic.
2. Text stamped and filled black:
 - a. 1/4 inch service indicator on top.
 - b. 1/2 inch valve number below.
3. Beaded chain tag fasteners.
4. Provide tag color coding to match pipe marker coding or as designated by the Contracting Agency.

C. Brass Stamped Tags:

1. Round, 1-1/2 inches diameter, brass with smooth edges.
2. Text stamped and filled black:
 - a. 1/4 inch service indicator on top.
 - b. 1/2 inch valve number below.
3. Beaded chain tag fasteners.

2.4 VALVE AND EQUIPMENT DIRECTORIES

A. Equipment and Valve Directory Frame:

1. 8-1/2" x 11" aluminum frame with plastic lens.
2. Provide multiple frames as required.

2.5 PIPE IDENTIFICATION, MARKING

A. Identify both service and flow direction.

B. Colors and Lettering: Conform to ANSI/ASME A13.1; see tables under Article 3.2E below.

- C. Plastic Pipe Labels:
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.
 - 2. Larger sizes may have maximum sheet size with plastic nylon ties or straps.
- D. Plastic Tape Pipe Labels: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.6 CEILING MARKERS

- A. Description:
 - 1. 7/8-inch diameter, color-coded.
 - 2. Metal push tacks or 0.030" rigid vinyl, pressure sensitive stickers.
- B. Provide color coding to match existing facility standards. In the absence of existing facility standards, utilize the color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Plumbing valves: Green.
 - 3. Non potable water and waste water valves: Orange.
 - 4. Heating/cooling valves: Blue.
 - 5. Fire suppression valves and drains: Red.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to be painted or directly receive adhesive labels.
- B. Install identifying devices after completion of coverings and painting.

3.2 INSTALLATION

- A. Do not install identifying devices over factory installed equipment labels.
- B. Locate identifying devices in clear view for simple identification.
- C. Tag automatic controls, instruments, and relays. Key these to control system schematic drawings.
- D. Frame and install approved equipment and valve directories in each mechanical room, at a location designated by the Contracting Agency.

E. Pipe Identification:

1. Identify piping, concealed or exposed, using ANSI A13.1 compliant pipe labels. Identify both service and flow direction in accordance with the following table. Coordinate color scheme with existing facility standards. In the absence of existing facility standards, utilize the color scheme in the following table.

Abbreviation	Legend	Color (Letters/Background)
CW	Domestic Cold Water	White/Green
HW	Domestic Hot Water	White/Green
HWC	Domestic Hot Water Circulation	White/Green
HWS	Heating Water Supply	White/Green
HWR	Heating Water Return	White/Green
GHS	Glycol Heating Supply	White/Green
GHR	Glycol Heating Return	White/Green
RL	Refrigeration - Liquid	Black/Orange
RS	Refrigeration - Suction	Black/Orange
NG	Natural Gas	Black/Yellow
W	Sanitary Drain	White/Green
V	Sanitary Vent	White/Green
RL, ORL	Rain Leader, Overflow Rain Leader	White/Green
SD	Storm Drain	White/Green
FW	Fire Suppression Water	White/Red

2. Pipe label letters shall be a minimum of 1/2" high and increase with pipe diameter as follows:

3. Pipe Outside Diameter	4. Letter Height
5. 0.75" to 1.25"	6. 0.5"
7. 1.5" to 2"	8. 0.75"
9. 2.5" to 6"	10. 1.25"
11. 8" to 10"	12. 2.5"
13. over 10"	14. 3.5"

15. Install labels in unobstructed view and aligned with horizontal or vertical axis of piping as appropriate. For piping located above the normal line of vision, place labels below the horizontal centerline of the pipe for clear unobstructed view from below.
16. Install labels not to exceed 20 foot intervals along straight piping runs (including risers and drops), close to valves, adjacent to changes in direction and branches, on each side of pipe penetrations through walls or floors, and at each access panel.

17. Medical gas piping shall be identified and labeled as required by NFPA 99, see Section 226300 - Medical Gas Systems.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Specific requirements, products and methods of execution which relate to the insulation of ducts, fittings, equipment, pipes, and other surfaces of the mechanical installation.
- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 221100 - Domestic Water Piping and Specialties
 - 3. 221300 - Sanitary Waste and Vent Piping and Specialties
 - 4. 224000 - Plumbing Fixtures
 - 5. 232113 - Hydronic Piping and Specialties
 - 6. 233100 - Ducts and Accessories

1.2 REFERENCES

- A. See section 200000 - Mechanical General Requirements.
- B. ASHRAE 90.1 - 2022 Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. NFPA 90A - 2018 Standard for the Installation of Air Conditioning and Ventilating Systems.
- D. NFPA 90B - 2015 Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- E. MSS Standard Practice SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.3 DESCRIPTION

- A. Provide thermal insulation for ventilation system ductwork and building service piping.
- B. Provide insulation for exposed ADA plumbing fixture piping.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Qualifications: Submit manufacturer and Applicator qualifications.

1.6 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.8 WARRANTY

- A. See section 200000 - Mechanical General Requirements.

PART 2 - PRODUCTS

2.1 FIRE RATING OF MATERIALS

- A. Provide insulation products used aboveground in building with burning characteristics in compliance with NFPA Standards 90A and 90B: Flame Spread 25, Fuel Contributed 50, Smoke Developed 50. Tested according to UL 723, ASTM E84, or NFPA 255.
- B. Insulation specified for use underground and aboveground away from the building might have other burning characteristics. Use such products only where specifically required.

2.2 FIBERGLASS INSULATION

- A. Piping (Domestic water, Vent-Thru Roof, and Hydronic): Provide insulation products as follows:
 - 1. Thermal conductivity K equals 0.24 at 100 degrees F mean temperature, ASTM C335.
 - 2. Factory applied vapor-barrier, flame retardant all service jacket and tape, with permeability rating equal to 0.02 perms, ASTM E 96.
 - 3. Temperature limits for fiberglass pipe insulation: 350 degrees F, unless otherwise indicated.
 - 4. Manufacturers: Johns Manville, Owens Corning, Knauf Fiber Glass, or approved equal.
- B. Ductwork: Provide insulation products as follows:
 - 1. Flexible insulation: Average thermal conductivity K equals 0.24 at 75 degrees F mean temperature at 1.5 pounds per cubic feet (PCF) density, ASTM C335.
 - 2. Rigid insulation: Average thermal conductivity K equals 0.24 at 75 degrees F mean temperature at 3.0 PCF density, ASTM C518.
 - 3. Factory-applied vapor barrier flame-retardant Foil-Scrim-Kraft (FSK) or all-service jacket and tape, with permeability rating equal to 0.02 perms, ASTM E 96.
 - 4. Temperature limits for fiberglass duct insulation: 250 degrees F unless otherwise indicated.
 - 5. Manufacturers: Johns Manville, Owens Corning, Certainteed, Knauf Fiber Glass, or approved equal.

2.3 FIRE RESISTIVE PIPE AND DUCT WRAP

- A. Lightweight, asbestos free high temperature inorganic ceramic fiber blanket totally encapsulated in foil/scrim having a service temperature up to 2,300 degrees F.

- B. Performance requirements:
 - 1. Two-hour rated fire resistive enclosure assembly, ASTM E119.
 - 2. Zero clearance to combustible, maximum surface temperature on unexposed side, UL 1978.
 - 3. Class I interior finish materials, ASTM E84.
 - 4. Through-penetration protection systems for grease and air ducts, ASTM E814 and UL 1479.
- C. Provide manufacturer's tapes, banding materials, pins/washers, through-penetration fire stop materials, duct access doors, and miscellaneous hardware necessary for complete installation according to manufacturer's instructions.
- D. Manufacturer: 3M.

2.4 FLEXIBLE FOAM PLASTIC

- A. Thermal Conductivity: 0.27.
- B. Water Vapor Transmission: 0.08.
- C. Flame-spread rating of 25 or less and a smoke-developed rating of 50 or less as tested by ASTM E 84.
- D. Manufacturer: Armaflex, Aerotube, Rubatex.

2.5 FIXTURE INSULATION ASSEMBLY

- A. Protective, molded, fire-resistant foam insulation, single piece insulation manufactured specifically for plumbing fixture supplies and drains.
- B. 4.5 PCF foam with insulation R factor 2, white fire retardant polyurethane integral skin, twist fasteners.
- C. Manufacturer: Skal+Gard, Model SG-100B, TCI Products, or approved equal.

2.6 CANVAS JACKETING

- A. Insulating Lagging Canvas: Eight ounces per square yard minimum, fire-retardant material complying with fire ratings specified above. Manufacturer: Chas Harmon "Osnaberg", Claremont Company Inc., "Claretex", or approved equal.
- B. Lagging Adhesive: Plastic synthetic resin emulsion adhesive; watertight, mildew resistant, fire retardant. Manufacturer: Childers Chil-Perm CP, Foster® Sealfas® coating 30-36, or approved equal.

2.7 METAL JACKETING

- A. 27 gauge (U.S. Standard) heavy corrugated aluminum.
- B. Preformed fitting covers.

2.8 COATINGS

- A. Coatings: UL labeled.
- B. On cold or dual service lines, use vapor barrier type coatings.

2.9 PREFORMED FITTING COVERS

- A. One piece pre-molded PVC jacketing and fitting covers specifically designed for the service intended.
- B. Install per manufacturer's instructions and secure with manufacturer's color matching PVC tape.
- C. Manufacturer: J-M "Zeston", TeeCee, Proto, Certainteed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply insulation materials until surfaces to be covered are clean and dry and foreign material such as rust, dirt, etc. is removed. Keep insulation clean and dry during installation and during the application of any finish.
- B. Do not install the insulation on pipe fittings and pipe joints until the piping has been tested and approved.
- C. Do not install the insulation on ducts or fittings until the ductwork has been tested and approved.
- D. Do not apply under conditions of excessive humidity or at temperatures below 50 degrees F or above 100 degrees F.
- E. Provide insulation support blocks, shields, and transitions for hangers, supports, anchors, and guides. Coordinate insulation requirements through rated assemblies and Listing penetration's requirements.
- F. Adjust hangers, guides, anchors, and supports after insulation installation has been approved.

3.2 PIPE INSULATION

- A. Cold Piping:
 - 1. Includes rainwater piping, domestic cold water, plumbing, and other vents through roof, refrigeration, and other cold piping to zero degrees F.
 - a. Insulate aboveground rain leaders from the roof drain to the point pipe penetrates building skin or below grade. Cover underside of roof drain.
 - b. Insulate plumbing vents from three feet below the under deck of the roof to the termination above the roofline.
 - 2. Insulate with sectional fiberglass (except for refrigerant piping) and provide a completely sealed vapor barrier. Provide insulation thickness per Insulation Thickness Table.
 - 3. Insulate valves, unions, flanges, fittings, tanks, vessels, air separators, heat exchangers, and similar components, except where indicated otherwise.

4. Insulate refrigerant piping with flexible foam plastic insulation and glue seams with manufacturer’s recommended cement.
- B. Hot Piping:
1. Includes domestic hot water supply and recirculation, and hydronic heating.
 2. Insulate with sectional fiberglass. Provide insulation thickness per Insulation Thickness Table.
 3. Insulate valves, unions, flanges, fittings, tanks, vessels, air separators, heat exchangers, steam and process vents, and similar components, except where indicated otherwise.
- C. Buried Piping. Insulate with flexible foam plastic insulation; glue seams with manufacturers recommended cement.
- D. In addition to specified jackets, provide heavy corrugated aluminum jacket on piping insulation anywhere piping is exposed to building exterior.
- E. Insulation Thickness Table (units are in inches):

Fluid Design Operating Temperature Range	Less than 1	1 to <1-1/2	1-1/2 to <4	4 to <8	8 and up
Heating Systems (Water and Glycol Solutions) and Domestic (Hot Water and Hot Water Circulation):					
141 °F to 200 °F	1.5	1.5	2	2	2
105 °F to 140 °F	1.5	1.5	2	2	2
Cooling Systems (Well water, Chilled Water and Glycol Solutions, and Refrigerant):					
40 °F to 60 °F	1.5	1.5	1.5	1.5	1.5
Below 40 °F	1.5	1.5	1.5	1.5	1.5
Heat Recovery Systems (Water and Glycol Solutions):					
35 degrees F to 90 degrees F	1	1	1.5	1.5	1.5
Domestic Cold Water:					
All	1	1	1.5	1.5	1.5
Rain leaders, Plumbing vents through roof:					
All	1	1	1.5	1.5	1.5

3.3 TECHNIQUE FOR APPLICATION TO PIPES

- A. Close longitudinal joints of pipe insulation firmly and butt insulation sections firmly together. Neatly and smoothly adhere laps and butt strips.
- B. Clean the contact area on jacket for adhesive lap strips and butt strips so it is free from fingerprints, oil, construction dust and other contaminants. Clean surfaces with tack rags, methanol, or other suitable agent before attempting to adhere the strip. Apply pressure to adhesive strip with suitable tool immediately after adhering. Remove insulation with

inadequately sealed joints and install new sections. Outwardly clinching staples may be used to reinforce joints.

- C. Continuously seal vapor barriers. If staples are used at laps, seal the entire length of stapled lap with adhesive jacket tape applied as specified above for laps and butts. Sectionalize vapor barrier by sealing ends of insulation sections at not more than 25 feet intervals, to prevent moisture migrating lengthwise. Apply butt strips over joint as above.
- D. Provide double insulation thickness on piping in outside walls and within five feet of vehicle doors or other large openings.
- E. Except as indicated, locate pipe hangers and rollers outside insulation. Provide insulation saddles or sheet metal shields around insulation. On pipes two inches and larger, within the area of each insulation shield, use calcium silicate or cellular glass on the lower half of the insulation, equal in thickness to adjacent insulation.
- F. Where refrigerant piping is installed outdoors, provide flexible foam plastic insulation with sealed vapor barrier in addition to jacket specified.

3.4 TECHNIQUE FOR APPLICATION TO PIPE FITTINGS, EQUIPMENT, AND VALVES

- A. Insulate fittings, valves, and flanges to the same thickness as the pipe insulation.
- B. Any of the following methods of insulation are acceptable:
 - 1. Blanket Wrap: Wrap the fitting with compressed glass fiber blanket. Wire the blanket securely in place and cover with a smooth layer of insulating/finishing cement. Cover with glass mesh tape, adhering it with an adhesive coating.
 - 2. Fabricated Segments: Cut mitered segments from pipe insulation that has the same wall thickness as adjacent pipe insulation to form a cover which will fit snugly around the fitting. Wire the segments firmly in place and seal the joints with insulating/finishing cement. Apply adhesive coating and wrap with glass mesh tape, then apply another layer of the same coating over the whole assembly.
 - 3. Cement: Apply insulating or insulating/finishing cement, molding it to the contour of the fitting. When area is large, apply an under layer of cement, wrap this with glass mesh tape, then apply an outer layer of cement. If the insulation is not concealed the exposed surface of insulating/finishing cement shall have a final glass mesh tape wrap embedded in adhesive.
- C. In each of the listed methods, to protect the insulation against contact damage, apply an adhesive coating when the cement is completely dry and hard, then wrap with glass mesh tape. Apply another coating of adhesive over the whole assembly.
- D. In each of the listed methods, pre-formed fitting covers may be substituted for the tape and adhesive covering specified. Cement and tape fitting covers on cold piping to provide a positive vapor barrier.
- E. Removable insulation blankets of comparable insulation value for valves and where equipment require frequent adjustments or maintenance shall be provided; identify and coordinate during submittal process.

- F. After insulation has been installed adjust hangers for proper fit, maintain pipe grade and support.

3.5 DUCT THERMAL INSULATION REQUIREMENTS

- A. Insulate ductwork as follows:
 - 1. Insulate outside air intake ducts from air intake louver connection to equipment connections (including insulated isolation damper frame) with 2-inch rigid or semi-rigid board insulation.
 - 2. Insulate exhaust and relief ducts from point of discharge to and including back draft damper support frame with two inch rigid or semi-rigid board insulation.
 - 3. Supply air ductwork: When mechanical cooling is provided, insulate associated ventilation system supply ductwork from AHU connections to VAV terminal unit inlet connections with 1-1/2" inch thick fiberglass insulation.
 - 4. Return air ductwork: Insulate return air ductwork passing through unheated spaces, within in mechanical rooms and as indicated with 1-1/2" inch fiberglass insulation.
 - 5. Lined ductwork: Provide external duct insulation only when indicated in addition to duct lining.
- B. Insulation Type and Finish:
 - 1. Rigid or semi-rigid board where canvas or metal jacket is specified. May also be used in place of blanket insulation where practical.
 - 2. Blanket insulation where rigid board is not specified or indicated. Proper installation is critical. Loose joints and sagging insulation shall require re-insulation of entire branch or main duct before acceptance and during warranty period.
 - 3. Fiberglass or canvas jacket over board insulation in mechanical and boiler rooms less than 10 feet above finish floor, where exposed in finished rooms and where indicated. Seal jacket with vapor barrier lagging adhesive.
 - 4. Ductwork insulation to have a completely sealed vapor barrier, except segmental insulation on medium/high velocity trunk ducts and warm air ducts in concealed spaces, where approved.

3.6 DUCT SOUND INSULATION REQUIREMENTS

- A. Refer to Section 233100 - Ducts and Accessories.
- B. Install where shown.
- C. Install in accordance with manufacturers installation instructions. Completed installation shall be fastened tightly to ductwork and free of sags.

3.7 TECHNIQUE FOR APPLICATION TO DUCTWORK

- A. Rigid and Semi-rigid Insulation:
 - 1. Impaling Over Pins: Install insulation with edges tightly butted using adhesive and metal pins. Impale insulation on pins welded to the duct and secure with speed clips. Trim off pins close to speed clip. Space pins as required to hold insulation firmly against duct surface but not less than one pin per square foot.
 - 2. Other Method of Securement: If the welded pin method is not feasible, secure the insulation to the duct with adhesive. Cover the entire surface of the metal with adhesive when applying to the underside of horizontal ducts. Application to top and sides may be

in strips with a minimum of 50 percent coverage. Additionally, secure insulation with No. 16 galvanized wire on not more than 12 inches on center. Provide metal angle at corners to protect edges of insulation.

3. Vapor Barrier: Seal joints and speed clips with adhesive tape of similar construction to insulation jacket. Thoroughly clean contact surfaces for adhesive as specified under pipe insulation technique. Glass cloth tape set in adhesive may be used. Provide metal or plastic corner angles within eight feet of floor, walkway, or stairs.
4. Provide fiberglass or canvas jacket where specified. Completely cover with minimum 1/8" lagging adhesive. Cover canvas with two heavy coats of same adhesive and completely fill the weave. Inspect when dry for complete vapor barrier throughout and refinish as required.

B. Blanket Insulation:

1. Position insulation so that longitudinal seam will be underneath and not supporting weight of sheet. Remove a uniform strip of insulation from backing to provide a lap strip. Butt insulation and secure lap strip with outwardly clinching staples.
2. Use pins to secure blanket on large flat areas as specified for rigid insulation. Reinforce jacket at pin penetration where required.
3. Seal laps, staples and butt joints with adhesive tape of similar construction to insulation jack. Seal speed clips if used. Thoroughly clean contact surfaces for adhesive as specified under pipe insulation technique.
4. When system is under pressure, inspect insulation for inflation caused by improperly sealed ducts. Repair duct seal and reinsulate as necessary.
5. The Contracting Agency may inspect completed insulation and test taped joints for adhesion. Seal laps and butt tapes that can be removed with reasonable force shall require that entire branch or trunk duct be reinsulated.

3.8 FIRE RESISTIVE DUCT AND PIPE WRAP

- A. Install in accordance with manufacturer's instructions.
- B. Provide fire rated duct wrap on exhaust air duct from medical gas storage room to building exterior wall penetration as indicated on drawings.

3.9 FIXTURE INSULATION ASSEMBLY

- A. Insulate cold and hot water supply and waste piping exposed beneath sink and lavatory fixtures designated on drawings or specified in Section 224000 - Plumbing Fixtures, as intended for use by disabled persons. Install in accordance with ANSI A117.1 - 2009.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, fittings, and connections for domestic potable water system.
2. Mechanical coupling systems.
3. Piping accessories.
4. Valves.
5. Access doors.
6. Water Filter for Break Room

B. Related Sections:

1. 200000 - Mechanical General Requirements
2. 200505 - Mechanical Demolition
3. 200529 - Mechanical Hangers and Supports
4. 200548 - Mechanical Vibration and Seismic Control
5. 200553 - Mechanical Identification
6. 200700 - Mechanical Insulation
7. 211000 - Water Based Fire Suppression Systems
8. 221300 - Sanitary Waste and Vent Piping and Specialties
9. 224000 - Plumbing Fixtures
10. 230593 - Testing, Adjusting and Balancing

1.2 REFERENCES

A. Codes and Standards:

1. See section 200000 - Mechanical General Requirements.
2. Foundation for Cross-Connection Control and Hydraulic Research, 9th edition, University of Southern California.
3. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances.
4. 2011 Reduction of Lead in Drinking Water Act.
5. NSF/ANSI 61 - Drinking Water System Components - Health Effects.

B. Abbreviations, Acronyms and Definitions:

1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
2. Refer to section 200000 - Mechanical General Requirements for general mechanical related definitions.
3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. This section describes specific requirements, products and methods of execution for interrelated systems necessary for the various plumbing systems and equipment.
2. Wetted surfaces of pipes, fittings, valves, and equipment in potable water systems shall be lead free as defined by the 2011 Reduction of Lead in Drinking Water Act.

- B. Performance Requirements:
 - 1. Potable water systems shall perform quietly, with no objectionable vibration transmitted to the surrounding construction.
 - 2. Replace piping and equipment that does not perform as intended with properly operating equipment.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. Refer to Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed:
- B. Product Data:
 - 1. Submit product literature for items specified in Part 2 and those products required by the performance standards of this section. Literature clearly annotated to indicate specified salient features and performance criteria.
 - 2. Indicate valve data and ratings.
 - 3. Provide plumbing specialty component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings:
 - 1. This Section shop drawings to be submitted under Section 200000 - Mechanical General Requirements.
 - 2. Show placement of fixtures and plumbing equipment.
- D. Certificates: Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation of cross contamination protection devices.
- E. Manufacturer's Installation, Operation, and Maintenance (IO&M) Manuals.
- F. Test and Evaluation Reports:
 - 1. Submit hydrostatic pressure test report.
 - 2. Submit sterilization of system report.

1.6 CLOSEOUT SUBMITTALS:

- A. Refer to Section 200000 - Mechanical General Requirements for general closeout submittal requirements for the items listed below, supplemented with the additional requirements listed:

1.7 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.9 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 WATER SERVICE PIPING (ABOVE GRADE INSIDE BUILDING)

- A. Copper (Hard drawn):
 - 1. Tubing: Type L (ASTM B88).
 - 2. Fittings:
 - a. Cast copper alloy (ASME B16.18).
 - b. Wrought copper and bronze (ASME B16.22).
 - 3. Joints: Solder, Grade 95TA (ASTM B32).
- B. Copper Press Fitting System:
 - 1. Limited to tubing sizes 4 inch and smaller.
 - 2. Cast or wrought copper fittings, ASME B16.18 or ASME B16.22. Pre-formed grooves with pre-lubricated EPDM O-rings designed to seal fitting to copper tubing water tight with the use of manufacturer's crimping tool. Fittings shall be rated for 250 degrees F and 200 PSI.
 - 3. IAPMO UPC listing.
 - 4. Manufacturer: Viega ProPress, NIBCO Press System, no substitutions.

2.2 UNIONS (STANDARD)

- A. Steel Piping (Threaded):
 - 1. Class 150 malleable iron, ground joint, copper or copper alloy seat. AnvilStar Figure 463. (150 PSIG steam, 300 WOG).
 - 2. Where indicated: Class 250 malleable iron ground joint, copper or copper alloy seat. AnvilStar Figure 554.
- B. Copper Piping (Sweat and Threaded): Cast bronze, ground joint, copper to copper, or copper to threaded joint. Nibco 733-LF series.

2.3 DIELECTRIC ISOLATORS (ELECTRICALLY INSULATING)

- A. Provide dielectric unions for 2 inch pipe and smaller.
- B. Provide dielectric flanges for 2-1/2 inch pipe and larger.
- C. Insulating gaskets, all types, shall be suitable for fluid type, temperature and pressure.
- D. Galvanized pipe to copper: Brass threaded end and sweat copper end.
- E. Black steel to copper: Zinc plated steel threaded end and sweat copper end.
- F. Manufacturers: Capitol, Epc, Control Plastics, Watts, or approved equal.

2.4 VALVES

A. General:

1. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 PSIG saturated steam or 200 PSIG WOG. Packing material or seals shall not contain asbestos.

B. Ball Valves:

1. Two (2) inch and smaller: Two piece type, full port, bronze body and silicone bronze ball or chrome plated brass ball, TFE seats, blowout proof stem, 150 PSIG pressure/temperature rating (steam).
2. Two and one half (2-1/2) inches through four (4) inch: Two piece type, full port, bronze body and silicone bronze ball or chrome plated brass ball, TFE seats, 150 PSIG pressure/temperature rating (steam). May be substituted for gate valves except where otherwise indicated.

C. Gate Valves:

1. Two (2) inch and smaller: Bronze body and trim, rising stem, solid wedge. Use only where shown on drawings.
2. Two and one half (2-1/2) inch through four (4) inch: Iron-body, bronze trim, flanged threaded or sweat fitting. Non-rising stem: Inside screw. Rising stem: OS&Y. Bronze valves optional for 2-1/2 inch and three-inch.

D. Swing Check Valves:

1. Two (2) inch and smaller: Bronze body, horizontal swing, Y-pattern, Buna-N-disc for water, oil and gas. TFE disc for steam.
2. Two and one half (2-1/2) inch and larger: Iron body, horizontal swing, bolted bonnet, renewable bronze seat and disc, flanged.
 - a. Bronze valves optional for 2-1/2 inch and 3 inch.

E. Drain Valves:

1. Full port ball valve with threaded hose adapter with bronze end cap.
2. Do not use sillcocks or butterfly valves as drain valves.

2.5 BALANCING VALVES

- A. Provide a balancing valve at each point shown on the domestic hot water recirculation branches. Except as indicated, balancing valves shall be full line size. Wide open pressure drop selected at one PSI (2.3 feet) (nominal).
- B. Provide calibrated plug or ball valve type balancing valves with self-sealing quick connect pressure taps, scale and locking device, NSF-61 approved for potable water use. Include schedule with submittal.
- C. Manufacturer: Bell & Gossett, or equal.
- D. Provide test kit with gauge and hoses to match balancing valves.

2.6 AUTOMATIC FLOW LIMITING VALVES

- A. Provide automatic flow limiting valves where shown on the Drawings.

- B. Provide valves with integral isolation valve, strainer, and pressure test ports. NFS-61 approved for potable water use.
- C. Provide valve with maximum flow set to design flow of the heat transfer device being served as scheduled.
- D. Manufacturer: Griswold Controls, or equal.

2.7 ACCESS DOORS

- A. Provide access doors for mechanical systems in accordance with Section 083113 - Access Doors and Frames.
- B. Provide UL labeled access doors and panels when required for fire resistance of surrounding construction.
- C. Provide key locks on access doors located in public areas below eight feet above finished floor.
- D. Prime coat steel.
- E. Coordinate location and size of access doors in walls, partitions, floors, and ceilings to correspond with valves, trap primers, cleanouts, and other devices requiring service or adjustment. Maintain any fire rating of the surrounding construction.
- F. Manufacturers: Elmdor, KARP, Milcor, MIFAB.

2.8 WATER FILTER SYSTEM FOR BREAK ROOM

- A. Inline water filter designed to reduce particulate, chlorine taste, odor, and scale.
- B. NSF certified, rated to 1.5 GPM flowrate and 10,000 gallons capacity.
- C. Plastic housing with replaceable filter cartridge.
- D. Rated to 125 psig operating pressure and 100 deg F operating temperature.
- E. Furnish Owner with 1 spare filter cartridge.
- F. Manufacturer: 3M BREW125-MS, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions: Cover equipment and plug piping connections to protect components from construction dirt and debris.
- B. Surface Preparation:
 - 1. Verify that excavations are to required grade, dry, and not over-excavated.
 - 2. Refer to Section 200556 - Interior Trench Excavation and Backfill.

3.2 INSTALLATION

- A. Interface with Other Work:
1. Review architectural drawings. Coordinate locations of access panels prior to piping installation.
 2. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
 3. Rework required as a result of failure to follow the manufacturer's written installation instructions or to properly coordinate with related work shall be completed at no additional expense to the Owner.
 4. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 9 for instructions on painting and coordination.
- B. Water Service Piping:
1. Install piping and plumbing products in accordance with UPC and manufacturer's instructions. Provide seismic anchoring, bracing, supports, and clearance for equipment, piping and sprinkler heads per UPC, IBC, and ASCE-07; most conservative criteria shall govern.
 2. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 3. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 4. At fixtures, install and connect hot water on left and cold water on right, as viewed when facing the fixture.
 5. Use of bullhead tee with opposed flow, double inlet configuration not allowed.
- C. Valves:
1. Provide accessible ball type isolation valves at major piping branches, and on main lines as shown, and at terminal devices.
 2. Install balancing valves for hot water recirculation system to be accessible and adjustable.
- D. Domestic Hot Water Thermal Expansion Tanks:
1. Field verify static pressure at cold water line at penthouse level and adjust to precharge to match water pressure.
 2. Extend existing housekeeping pad for expansion tank mounting. Coordinate pad size to accommodate tank seismic restraint anchorage and minimum anchor bold edge distance in accordance with Contractor's seismic restraint design.
- E. Water Hammer Arresters: Install in accordance with manufacturer recommendations.
- F. Provide finished products with protective covers during balance of construction.
- G. Access Doors: Provide appropriate size and install such that plumbing features are readily accessible and maintainable.
- H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- I. Install water filter in accordance with manufacturer recommendations.
1. Mount filter assembly inside sink base cabinet. Coordinate mounting location in base cabinet for maintenance access. Where base cabinets include a trash receptacle, locate water filter assembly away from trash receptacle.

2. Provide shutoff valves upstream and downstream of filter assembly for servicing.
3. Connect filter to cold water supply line.
4. Route filtered water line to coffee makers, ice makers, and instant hot water dispensers as indicated on drawings.

3.3 REPAIR/RESTORATION

- A. Repair any product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.

3.4 SITE QUALITY CONTROL

- A. Site Tests:
 1. Test water piping hydrostatically at 100 PSIG or 150 percent of working pressure, whichever is greater, for a period of four hours. Observe piping during this period and repair leaks and retest.
 2. Air Test:
 - a. In general, air testing is not acceptable. In the event of low temperature conditions that would subject system piping to freezing, an equivalent air pressure test may be conducted in accordance with the Uniform Plumbing Code with prior Contracting Agency approval.
 - b. Test with clean air at 150 percent of system working pressure but not less than 75 PSIG or more than 150 PSIG. System shall hold pressure for not less than four hours. Inspect joints using leak detecting fluid or soapy water. Repair leaks and retest.
 - c. Observe necessary safety procedures when testing with air including, but not limited to, use of protective goggles or face shields. Only persons directly involved in testing procedure shall be within 20 feet of a pipe under pressure.
 3. Test results shall be certified in writing as required by General Conditions. Include dates and sections tested, test pressure, test duration, printed names and signatures of person performing the test and Contracting Agency witnessing the test.
- B. Inspection:
 1. Arrange for inspections and provide notice to the Contracting Agency when the entire work or logical portions thereof, is ready for inspection.

3.5 SYSTEM STARTUP

- A. Start-up and operate plumbing systems and equipment in accordance with the manufacturer's written installation and operation manual checklist.
- B. Document start-up and operational checks using the checklist and submit in accordance with submittal requirements.
- C. Operationally test control and safety devices and record settings.
- D. Submit a copy of start-up report that includes final settings and that indicates that the start-up of each piece of equipment has been completed.

3.6 CLEANING

- A. Sterilization of Domestic Water Systems:
1. Sterilize each unit of completed supply line and distribution system with chlorine before acceptance for domestic operation.
 2. Sterilization as described below or by the system prescribed by the American Water Works Association Standard C-651. Apply the amount of chlorine to provide a dosage of not less than 50 PPM (parts per million). Provide chlorine manufactured in conformance to the following standards:
 - a. Liquid Chlorine: Federal Specification BB-C-120.
 - b. Hypochlorite: General Specification O-C-114a, type 11, Grade B or Federal Specification O-X-602.
 3. Introduce the chlorinating material to the water lines and distribution system after piping system has been thoroughly flushed. Maintain a contact period of not less than 24 hours. Flush the system with clean water until the residual chlorine content is not greater than 1.0 part per million.
 4. Open and close valves in the lines being sterilized several times during above chlorination.
 5. Certify in writing that sterilization has been completed in accordance with these requirements.
- B. After construction is completed, clean and wipe down exposed surfaces of pumps, piping and appurtenances.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary waste and vent pipe and fittings.
 - 2. Cleanouts.
- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200529 - Mechanical Hangers and Supports
 - 3. 200548 - Mechanical Vibration and Seismic Control
 - 4. 200553 - Mechanical Identification
 - 5. 200700 - Mechanical Insulation
 - 6. 221100 - Domestic Water Piping and Specialties
 - 7. 224000 - Plumbing Fixtures

1.2 REFERENCES

- A. Codes and Standards: See section 200000 - Mechanical General Requirements.
- B. Abbreviations, Acronyms and Definitions:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.
 - 4. ASA - American Supply Association.
 - 5. ASTM - American Society for Testing and Materials
 - 6. CISPI - Cast Iron Soil Pipe Institute.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: This section describes specific requirements, products and methods of execution for sanitary waste systems and equipment.
- B. Performance Requirements:
 - 1. Sanitary waste systems shall perform quietly, with no objectionable vibration transmitted to the surrounding construction.
 - 2. Replace piping that does not perform as intended with properly operating equipment.
 - 3. Provide products with performance, output or salient features indicated or scheduled on the drawings.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed:
- B. Product Data:
 - 1. Submit product literature for items specified in Part 2 and those products required by the performance standards of this section. Clearly annotate literature to indicate specified salient features and performance criteria.
 - 2. Provide plumbing specialty component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings:
 - 1. This Section shop drawings to be submitted under Section 200000 - Mechanical General Requirements.
 - 2. Indicate pipe grade and direction of slope. Indicate elevation of piping at the beginning and end of each main, and at branch connections.
 - 3. Coordinate exact locations of drains, floor penetrations and structural penetrations with applicable trades.
- D. Manufacturer's Installation, Operation and Maintenance Manuals.
- E. Test and Evaluation Reports:
 - 1. Submit pressure test report.
 - 2. Submit system flushing report.

1.6 CLOSEOUT SUBMITTALS

- A. See section 200000 - Mechanical General Requirements for general closeout submittal requirements for the items listed below, supplemented with the additional requirements listed:
- B. Warranty Documentation.
- C. Record Documentation:
 - 1. Record actual dimensioned locations for buried or inaccessible piping.
 - 2. Show actual cleanout locations and types.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.10 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPING, BURIED BENEATH AND WITHIN FIVE FEET OF BUILDING

- A. Hub-less Cast Iron Pipe and Fittings:
1. Manufacturers:
 - a. Charlotte Pipe and Foundry.
 - b. Tyler Pipe and Coupling.
 - c. AB&I Foundry.
 - d. Equal.
 2. Pipe: CISPI 301, ASA group 022.
 3. Fittings: Cast iron.
 4. Couplings:
 - a. Manufacturers:
 - 1). Husky Series 4000.
 - 2). Approved equal.
 - b. Materials:
 - 1). Heavy-duty 304-type stainless steel couplings and screws.
 - 2). Minimum shield thickness: 0.015 inch.
 - 3). Gaskets conforming to ASTM C564.

2.2 DRAINAGE PIPING, ABOVE GRADE

- A. Hub-less Cast Iron Pipe and Fittings:
1. Manufacturers:
 - a. Charlotte Pipe and Foundry.
 - b. Tyler Pipe and Coupling.
 - c. AB&I Foundry.
 - d. Equal.
 2. Pipe: CISPI 301, ASA group 022.
 3. Fittings: Cast iron.
 4. Couplings:
 - a. Manufacturers:
 - 1). Husky Series 2000
 - 2). MG Coupling
 - 3). Any other manufacturer meeting the requirements of the contract documents. Substitution request not required.
 - b. Description: No-hub cast iron pipe couplings conforming to standard CISPI 310.
 - c. Materials:
 - 1). Gaskets conforming to ASTM C564.
 - 2). Stainless steel clamp-and-shield assemblies.
- B. Copper Pipe, DWV: ASTM B75, ASTM B251, ASTM B302, ASTM B306.
1. Fittings: ASME B16.23 cast bronze, or ASME B16.29 wrought copper.
 2. Joints: ASTM B32, lead-free solder, Grade 50B.

- C. Copper Pipe, pumped application: Type L, ASTM B88.
 - 1. Fittings: ASME B16.23 cast bronze, or ASME B16.29 wrought copper.
 - 2. Joints: ASTM B32, lead-free solder, Grade 50B.

2.3 ADAPTERS

- A. Manufacturers:
 - 1. Romac.
 - 2. Any other manufacturer meeting the requirements of the contract documents. Substitution request not required.
- B. Use to connect pipes of same nominal size but different outside diameter or pipes of different material (cast iron to ductile iron, etc.).
- C. Rigid sleeve type coupling, ductile iron center ring and end rings, elastomeric gaskets, corrosion resistant bolts or polyethylene encasement.

2.4 CLEANOUTS

- A. Manufacturers:
 - 1. Zurn.
 - 2. Mifab.
 - 3. J.R. Smith.
 - 4. Any other manufacturer meeting the requirements of the contract documents. Substitution request not required.
- B. Floor Cleanouts:
 - 1. Cast iron body, bronze plug with neoprene gasket.
 - 2. Adjustable head to match finished floor elevation.
 - 3. Round, scoriated bronze top.
 - 4. Where indicated, provide cleanout tops with tile-terrazzo insert or carpet insert to match surrounding floor finish.
- C. Wall Cleanouts:
 - 1. Cast iron body, recessed bronze plug.
 - 2. Wall access panel or access cover with center screw.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to demolition, concrete saw-cutting and interior trench excavation, field verify depth of existing underground waste piping at basement level at proposed point of connection to verify sufficient depth for extension of waste piping as shown on drawings. Notify Owner and Engineer if piping is found to be of insufficient depth.

3.2 PREPARATION

- A. Interface with Other Work:
 - 1. Review architectural and millwork shop drawings. Confirm location of cleanouts and access panels prior to installation.
- B. Protection: Cover equipment and plug piping connections to protect components from construction dirt and debris.
- C. Surface Preparation:
 - 1. Verify that excavations are to required grade, dry, and not over-excavated.
 - 2. See Section 200556 - Interior Trench Excavation and Backfill.

3.3 INSTALLATION

- A. Install plumbing systems in accordance with manufacturer's instructions and listing.
- B. Provide finished products with protective covers during balance of construction.
- C. Access Doors: Provide appropriate size and install such that plumbing features are readily accessible and maintainable.
- D. Piping:
 - 1. Grading: Minimum 1/4 inch per foot unless indicated otherwise on drawings and approved by AHJ for shallower slopes.
 - 2. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 - 3. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 4. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 5. Where pipe support members are welded to structural building framing; scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 6. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 9 - Finishes.
 - 7. Connections:
 - a. Hub and hubless piping joints as specified above for underground piping.
 - b. Thread Joints: Assemble with TFE tape or approved non-hardening joint compound.
 - c. Solder Joints: Assemble with lead free solder.
 - d. Grooved and other joints: Assemble in accordance with manufacturer instructions.
- E. Vents:
 - 1. Install vents as indicated and as required by plumbing code. Add vents when field conditions increase the length of a trap arm or cause other changes in venting requirements.
 - 2. Unless otherwise indicated, the portion of the vent extending through roof shall be increased in size from one foot below roof assembly to termination as defined below. Increase as follows:
 - a. Vent size two-inch and under; vent thru roof three-inch.
 - b. Vent size three-inch; vent thru roof four-inch.
 - c. Vent size four-inch; vent thru roof six-inch.
 - d. Vent size six inch & larger; vent thru roof same size.
 - 3. Termination of Vent: As required by the Uniform Plumbing Code.

F. Cleanouts:

1. Provide as indicated on drawings.
2. If field conditions create additional offsets or increase length of piping shown, provide additional cleanouts as required by the Uniform Plumbing Code and AHJ.
3. Where practical or as indicated provide cleanouts on vertical rainwater piping immediately above grade.

3.4 REPAIR/RESTORATION

- A. Rework required as a result of failure to follow the manufacturer's written installation instructions or to properly coordinate with related Work shall be completed at no additional expense to the Owner.
- B. Repair any product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- C. Substitute replacement parts from other manufacturers are not acceptable.

3.5 FIELD QUALITY CONTROL

- A. Inspections: Arrange for inspections and provide notice to the Contracting Agency when the entire Work, or logical portions thereof, is ready for inspection.
- B. Maintain current as-built drawings on-site recording including invert elevations, connections to fixtures, cleanouts, slopes, pipe sizes, and routing of pipes. Annotate sections of lines with dates when pressure tests have been approved by AHJ.
- C. Pressure Tests:
 1. Water Test: Test waste and vent system with water in accordance with the Uniform Plumbing Code.
 2. Air Test:
 - a. In general, air testing is not acceptable. In the event of low temperature conditions that would subject system piping to freezing, an equivalent air pressure test may be conducted in accordance with the Uniform Plumbing Code with prior Contracting Agency approval.
 - b. Observe necessary safety procedures when testing with air including, but not limited to, use of protective goggles or face shields. Only persons directly involved in testing procedure shall be with 20 feet of a pipe under pressure.
 3. Test results shall be certified in writing as required by General Conditions. Include dates and sections tested, test pressure, test duration, printed names and signatures of person performing the test and Contracting Agency witnessing the test.
- D. Verify penetrations are installed to maintain assembly integrity.
- E. Coordinate with Divisions 26, 27 and 28 for power, disconnects, and related electrical items.

3.6 ADJUSTING

- A. Adjust functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.

3.7 CLEANING

- A. Clean and flush drain piping to remove dirt and foreign debris from systems.
- B. Clean exposed pipes, fittings, and materials.
- C. Provide written certification which documents that the complete sanitary sewer system has been flushed of foreign debris. Include date and printed names and signatures of person(s) performing the flush and Contracting Agency witnessing the flush.

3.8 CLOSEOUT ACTIVITIES

- A. Start-up and operate plumbing systems and equipment in accordance with the manufacturer's written installation and operation manual checklist.
- B. Document start-up and operational checks using the checklist and submit in accordance with submittal requirements.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lavatories.
 - 2. Sinks.
 - 3. ADA plumbing fixture piping insulation.

- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200548 - Mechanical Vibration and Seismic Control
 - 3. 200553 - Mechanical Identification
 - 4. 200700 - Mechanical Insulation
 - 5. 221100 - Domestic Water Piping and Specialties
 - 6. 221300 - Sanitary Waste and Vent Piping and Specialties

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. American Society of Safety Engineers (ASSE).

- B. Abbreviations, Acronyms and Definitions:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. See section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.
 - 4. GPF - Gallons Per Flush.
 - 5. PSI - Pounds per Square Inch.
 - 6. PSIG - Pounds per Square Inch Gauge.
 - 7. "Handicap", "Handicapped", or "ADA compliant": Refers to fixtures that comply with the requirements of ANSI A117.1.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. This section describes specific requirements, products and methods of execution for plumbing fixtures.
 - 2. Plumbing fixtures in potable water systems shall be lead free as defined by the 2011 Reduction of Lead in Drinking Water Act.

- B. Performance Requirements:
 - 1. Potable water systems shall perform quietly, with no objectionable vibration transmitted to the surrounding construction.
 - 2. Replace piping and fixtures that do not perform as intended with properly operating piping and fixtures.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data:
 - 1. Provide plumbing specialty component sizes, rough-in requirements, service sizes, and finishes.
 - 2. Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Shop Drawings:
 - 1. This Section shop drawings to be submitted under Section 200000 - Mechanical General Requirements.
 - 2. Indicate dimensions and weights of fixtures and equipment, and placement of openings and holes.
- D. Manufacturer's Installation, Operation, and Maintenance (IO&M) Manual.

1.6 CLOSEOUT SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.9 DELIVERY, STORAGE AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.10 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements, for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 FIXTURES

- A. Traps, Stops and Supplies:
 - 1. Provide traps, stops and supplies for fixtures.

2. Sink/lavatory P-Traps: 17 gauge chrome-plated tubular brass or cast brass.
 3. Supplies: Flexible, stainless steel.
 4. Stops: Quarter-turn, removable key type. Commercial quality metal components only; no plastic parts.
- B. Escutcheons: Provide chrome plated wall escutcheons for pipe penetrations into walls.
- C. Flush Valve Manufacturers: Sloan, Zurn, no substitutions.
- D. Lavatory Faucet Manufacturers: Delta, Chicago Faucets, no substitutions.
- E. Fixtures specified elsewhere, or otherwise furnished:
1. Provide appropriate strainer, tailpiece, trap, waste and supplies.
 2. Rough in and connect only.
- F. Handicapped Fixtures:
1. Provide fixtures in compliance with the appropriate standard listed in Part 1.
 2. Provide fixtures operable with one hand without grasping, pinching or twisting of the wrist, and requiring not more than five pounds of operating force.
 3. Handicap accessible lavatories and sinks: Where piping is exposed, provide fixture insulation assembly. Refer to Section 200700 - Mechanical Insulation.

2.2 SINKS

- A. P-6H Hand Wash Sink
1. Fixture: Existing fixture to be reused.
- B. P-19H Break Room Sink:
1. Fixture: Single compartment, 18 gauge, type 304 stainless steel, 31 inch by 22 inch by 5-1/2 inch deep bowl, self rimming, sound deadened, with strainer. Coordinate faucet hole punching locations for faucet, instant hot water dispenser, and dishwasher airgap fitting. ADA compliant. Elkay model DLRS332210.
 2. Faucet: Single hole, single handle, with pull down sprayer. ADA compliant. Delta 9159-DST.
 3. Hot water dispenser: In-Sink-Erator Model H-HOT100; 200 degrees F, 115 volt, 750 watts.

2.3 SUPPLY WALL BOXES

- A. WB-1 – Icemaker and Dishwasher Outlet Box:
1. Fixture: 18 gauge white powder coated steel box and cover, bottom water supply with quarter turn valve and integral water hammer arrester.
 2. Piping: Bottom water supply, 3/8-inch compression outlet, 1/2-inch NPT or 5/8-inch OD sweat combo connection inlet, 2-inch slip nut drain connection.
 3. Guy Gray RMDW1AB.

2.4 ADA PLUMBING FIXTURE PIPING INSULATION ASSEMBLY

- A. Manufacturer: Skal+Gard, Model SG-100B, TCI Products, or approved equal.

- B. Description: Protective, molded, fire-resistant foam, single piece insulation manufactured specifically for plumbing fixture supplies and drains.
- C. Performance/Design Criteria: Insulation R factor 2.
- D. Materials:
 - 1. Foam: 4.5 pounds per cubic foot.
 - 2. Skin: White fire retardant polyurethane.
 - 3. Twist fasteners.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Installer: Perform work by experienced personnel previously engaged in plumbing system construction and fixture installation, and under the supervision of a qualified installation supervisor.

3.2 PREPARATION

- A. Confirm location and size of fixtures and openings before piping rough-in and installation.
- B. Verify that rough-ins have been provided, are correctly sized and are located within dimensional tolerances for fixtures to be installed prior to installation of fixtures.
- C. Interface with other Work: Review Architectural drawings and millwork shop drawings to verify correct fixture locations.

3.3 INSTALLATION

- A. Install piping and plumbing products in accordance with UPC and manufacturer's instructions. Provide seismic anchoring, bracing, supports, and clearance for equipment, piping, and sprinkler heads per UPC, IBC, and ASCE-07; most conservative criteria shall govern.
- B. Provide permanent metal and wire positioners, supports, and carriers to secure fixtures and piping rigidly in proper alignment without sway or sideplay.
- C. Anchor fixtures securely to withstand applied vertical load of not less than 250 pounds on the front of the fixture, without noticeable movement.
- D. Install fixtures plumb, level and to the finished architectural surface, so that the maximum gap between the fixture and the surface does not exceed 3/16 inch. Caulk the edge of the joint between fixture and surface with silicone or butyl type waterproof caulking compound.
- E. Install and connect hot water on left and cold water on right, as viewed when facing the fixture.
- F. Locate flush valve handles on handicapped accessible water closets on the wide side of the stall. Mount Accessible fixtures shown in the ADA guidelines to the heights indicated.

- G. ADA Plumbing Fixture Insulation Assembly:
 - 1. Insulate hot water supply and waste piping exposed beneath sink and lavatory fixtures designated on drawings or specified in this section, as intended for use by the handicapped.
 - 2. Install in accordance with ANSI A117.1.

H. Coordinate plumbing rough-in with Owner Furnished equipment and fixtures.

3.4 REPAIR/RESTORATION

- A. Repair any product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.

3.5 SITE QUALITY CONTROL

- A. Non-Conforming Work: Rework required as a result of failure to follow the manufacturer's written installation instructions or to properly coordinate with related Work shall be completed at no additional expense to the Owner.

3.6 ADJUSTING

- A. Adjust functional components for proper operation in accordance with manufacturers' recommendations, or as otherwise directed.

3.7 CLEANING

- A. Clean fixtures and trim to a clean condition. Obtain a written certification from the Owner that this has been accomplished and accepted.

3.8 CLOSEOUT ACTIVITIES

- A. Demonstration: Provide 1hour of demonstration conducted by authorized factory start-up personnel to the Contracting Agencies authorized maintenance personnel.
- B. Training: Provide 1hour of operational instruction conducted by authorized factory start-up personnel to the Contracting Agencies authorized maintenance personnel.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Ductwork and ventilation system equipment cleaning, servicing and adjustment.
- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200700 - Mechanical Insulation
 - 3. 204100 - Mechanical Demolition
 - 4. 233100 - Ducts and Accessories
 - 5. 233600 - Air Terminal Units
 - 6. 233700 - Air Outlets and Inlets

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. ACR the National Air Duct Cleaners Association (NADCA) Standard for Assessment, Cleaning and Restoration of HVAC Systems, 2021.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: This section describes specific requirements and methods for cleaning existing ventilation ductwork and equipment.
- B. Performance Requirements:
 - 1. Install new and replace existing duct access doors as required.
 - 2. Clean and inspect supply air diffusers and return air grilles.
 - 3. Remove and replace existing flexible ductwork.
 - 4. Clean terminal air units to include fans and reheat coils.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data: Submit material safety data sheets (MSDS) for chemical products proposed to be used in cleaning process

- C. Shop Drawings:
1. Select and document new duct access point/door locations and sizes on a clean set of Contract Drawings during cleaning preparation, using the access door symbol provided in the Legend.
 2. Submit for approval by the Contracting Agency prior to installing duct access points/doors.
- D. Test and Evaluation Reports:
1. Preliminary Report:
 - a. Prior to any cleaning or duct repair work, provide a formal written preliminary report which:
 - 1). Defines the physical limits/boundaries of the existing central air distribution system ductwork and equipment to be cleaned.
 - 2). Provides a general assessment of the condition of the existing ductwork and equipment to be cleaned.
 - 3). Includes “before” digital photographs for each section of ductwork and equipment to be cleaned which clearly documents the existing condition of the ductwork. Include a key map (floor plan(s)) which clearly shows the location and direction of each photograph taken.
 - 4). Includes official laboratory analysis report of representative duct contamination samples. Indicate where samples were taken on key map (floor plans).
 - 5). Provides recommendations regarding the most appropriate cleaning method(s) for each portion of the duct system and equipment to be cleaned. Use cleaning methods selected from the National Air Duct Cleaners Association (NADCA) Industry Standard for Mechanical Cleaning of Non-Porous Air Conveyance System Components.
 - 6). Includes a copy of the specific recommended cleaning procedures to be implemented.
 2. Final Condition Report:
 - a. Within 15 days of completed duct and equipment cleaning, provide a formal written final condition report which:
 - 1). Demonstrates that there is no visible dirt, contamination, or bacterial growth, at any point within the systems which were cleaned.
 - 2). Includes “after” digital photographs next to each “before” digital photograph for each section of ductwork and each piece of equipment which clearly documents the cleaning process. Take the “after” photograph from the same orientation as the previously submitted “before” photograph.
- E. Quality Control Submittals: Submit references for a minimum of five recently successfully duct cleaning projects.

1.6 CLOSEOUT SUBMITTALS

- A. See Section 200000 - Mechanical General Requirements.

1.7 QUALITY ASSURANCE

- A. See Section 200000 - Mechanical General Requirements.
- B. Qualifications: Duct cleaning work shall be performed by a firm with three years of continuous, documented experience with similar work.

- C. Certifications: The HVAC system cleaning contractor shall have a minimum of one Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

PART 2 - PRODUCTS

2.1 CLEANING EQUIPMENT AND CLEANING PERSONNEL

- A. Provide equipment and materials for cleaning, inspection and repair work including scaffolding, wire brushes, rotary brushes, filters, air lances, mechanical agitators, fiber-optic bore scopes, vacuums, and other equipment and materials necessary for workmen to perform the specified work.
- B. Cleaning personnel shall be properly supervised by a qualified, experienced foreman. Foreman shall be prepared to discuss work in progress, at anytime with the Contracting Agency.
- C. Provide HEPA systems which are self-contained units with appropriate components and appurtenances, to adequately prevent dirt and debris loosed from duct mains and branches during cleaning operations from entering sensitive locations. Utilize industrial grade HEPA filter elements labeled and certified for 99.9 percent efficiency (0.3 micron particles at rated air flow). Wherever practicable, do not discharge air from HEPA systems to clean spaces. Size volumetric capacity of HEPA filter system to match CFM rating of diffuser, mixing box, ductwork section or device to which unit is being connected.

2.2 ACCESS DOORS

- A. Refer to Section 233100 - Ducts and Accessories.

2.3 FLEXIBLE DUCT

- A. Refer to Section 233100 - Ducts and Accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Study the Contract Documents and facility record drawings provided by the Contracting Agency to become familiar with the general layout of the existing systems to be cleaned.
 - 2. Conduct site visit(s) to verify the scope of work, accessibility to ductwork and equipment and existing conditions.
- B. Obtain written Notice to Proceed from the Contracting Agency prior to beginning duct and equipment cleaning procedures.

3.2 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Prior to cleaning, provide temporary 30 percent filters fitted and sealed at supply grilles and diffusers.
 - 2. Protect openings to avoid particulate contamination and debris from falling into conditioned air spaces.

3.3 INSTALLATION

- A. Install access points/doors at approved locations throughout supply, return and exhaust air ductwork. Install access points/doors as follows:
 - 1. Install access points/doors at not greater than 20-foot intervals to allow cleaning and inspection of each segment of ductwork.
 - 2. Do not cut into existing ductwork other than to install new access doors.
 - 3. Record location of each access door on project record drawings. Use access door symbol as indicated in Legend.
 - 4. When access doors are installed in insulated ductwork, provide access doors which meet the "R" rating of the duct insulation.
- B. Where existing access doors are missing or poorly fitted, report condition to the Contracting Agency.

3.4 PRE-CLEANING INSPECTION

- A. Perform an inspection of the duct interior through the installed access points/doors as follows:
 - 1. Utilizing a fiber-optic bore scope with dedicated light source to inspect interior ductwork surfaces and ductwork accessories including terminal units, mixing boxes, ductwork liners, duct-mounted coils, filters, dampers, humidifiers, and other appurtenances within ductwork systems.
 - 2. Visually inspect air handlers and air handler components. Visual inspection shall include, but not be limited to filters, coils, holding frames, fans, flooring, ceilings, wall paneling, air plenums, dampers, and outside air intakes.
- B. Submit representative samples of duct contamination to a third party laboratory for analysis. Submit written laboratory report to Contracting Agency for review.
- C. Prepare and submit Preliminary Report as outlined in Submittals. Promptly notify the Contracting Agency in writing of any existing conditions/major damage that may prevent the complete cleaning of the air distribution systems as shown.

3.5 DUCT CLEANING

- A. Control access for cleaning personnel and equipment through installed access points, existing ceiling tiles, access doors, diffusers or grilles. Replace items removed for access to their original state upon completion of work.
- B. Upon satisfactory laboratory analyses of duct contamination samples and with temporary filters installed, remove loose contaminants from the interior ductwork surfaces. Perform visual inspections throughout the entire process to ensure that no area(s) are left untreated.

- C. By inserting special air lances, mechanical agitators and rotary brushes through the installed access points, gently loosen and remove contaminants from the interior surfaces of the ductwork. Utilize temporary filters and blanking pieces to protect areas that are not currently being treated.
- D. Utilize specialized fan-powered, HEPA filtered dust and particulate collection systems in areas designated as being sensitive and as directed by the Contracting Agency. Take precautions to prevent dirt and debris greater or equal to 0.5 microns from entering these sensitive areas.
- E. Mark duct mounted dampers at their current setting. Then inspect and clean dampers by manually hand scraping, sanding or wire brushing. Lubricate external moving parts with an approved dry lubricant material (Aerolox Dry Moly or equal). After cleaning, repair damaged dampers to provide proper operation and return and lock dampers at original setting positions.
- F. Repair/replace existing damaged duct insulation. If existing insulation is exposed without neoprene, foil or approved facing, coat surface with sealer. See Section 20 0700 - Mechanical Insulation, for sealer requirements.
- G. Whenever supply/diffusers and return/exhaust grilles are removable, mark existing damper settings (as applicable) and remove them prior to cleaning. Vacuum clean, wash, dry and reinstall diffusers and grilles. Clean welded grilles in place. Return dampers to original setting positions after reinstallation.

3.6 REPAIR/RESTORATION

- A. Upon completion of the ductwork and equipment cleaning, carefully remove filters from the ceiling diffusers to avoid spilling loose contamination onto room surfaces. Dispose of filters in sealed containers.
- B. Shut and latch access doors. Adjust as necessary for a tight air seal.

3.7 CLEANING

- A. Sanitize ductwork based upon the preliminary report laboratory analysis recommendations of duct contamination samples. Using a special extension lance and atomizing nozzle, coat the interior surfaces of the ductwork with a fine mist of an approved sanitizing fluid through the installed access points. Sanitizing fluid shall be registered with Environmental Protection Agency LD-50 toxicity tests.
- B. Upon completion of work, and at the end of each shift, clean work area of trash, rubble, rags, containers, materials and equipment resulting from the work and remove from site. Broom clean Contracting Agency designated work/storage areas.
- C. When cleaning procedures are completed, return electrical switches, detection devices and system components to an operable state by qualified personnel.
- D. Plug access ports with plugs specifically designed for the intended purpose.

3.8 SITE TESTS AND INSPECTIONS

- A. Provide Contracting Agency with 48 hours advanced notice prior to site inspection.

- B. Visually inspect cleaned duct interior surfaces, ductwork accessories and air handlers as identified in the project's scope of work.
- C. Inspect ductwork interior surfaces and non-accessible ductwork components within the air stream via the installed access points/doors, utilizing the fiber optic bore scope with dedicated light source.
- D. Photo document post cleaning conditions and submit with Final Condition Report. See Submittals - Test and Evaluation Reports for specific report requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: General requirements and methods of execution relating to the testing and balancing of the mechanical systems provided on this project.
- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 221100 - Domestic Water Piping and Specialties
 - 3. 232113 - Hydronic Piping and Specialties
 - 4. 233100 - Ducts and Accessories
 - 5. 233600 - Air Terminal Units
 - 6. 233700 - Air Outlets and Inlets
 - 7. 259000 - Sequence of Operations

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. National Environmental Balancing Bureau - Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - 3. National Environmental Balancing Bureau - Testing, Adjusting, Balancing Manual for Technicians.
 - 4. SMACNA - HVAC SYSTEMS Testing, Adjusting, and Balancing.
- B. Abbreviations and Acronyms:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.
 - 3. TAB: Testing, Adjusting, and Balancing.
 - 4. NEBB: National Environmental Balancing Bureau
- C. Definitions:
 - 1. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 2. Accuracy: Capability of an instrument to indicate the true value of a measured quantity.
 - 3. Adjusting: Varying of system flows by partially closing balancing devices, such as dampers, and valves, and varying fan speeds to achieve optimum system operating conditions within design and installation limitations.
 - 4. Balancing: Methodical proportioning of air and hydronic flows through the system main, branches, and terminal devices using acceptable procedures to achieve the specified air or hydronic flow with testing and design limitations.
 - 5. Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.
 - 6. NEBB Certified TAB Firm: A Firm that has met and maintains all the requirements of the NEBB for Firm certification in TAB and is currently certified by NEBB. A NEBB Certified Firm shall employ at least one NEBB Qualified TAB Supervisor in the full time management position.

7. NEBB Certified TAB Report: Data presented in a NEBB Certified TAB Report accurately represents system measurements obtained in accordance with the current edition of the *NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems*. Variances from design quantities that exceed NEBB or contract document tolerances are to be noted in the TAB report project summary.
8. NEBB Qualified TAB Supervisor: Full time employee of the TAB Firm in a management position who has successfully passed the supervisor level written and practical qualification examinations and maintains the Supervisor re-qualification requirements of NEBB.
9. NEBB Qualified Technician: Full time employee of the TAB Firm who has met the technician level experience requirements of NEBB and has successfully passed the technician level written and practical qualification examinations. A NEBB Qualified TAB Technician shall be supervised by a NEBB Qualified TAB Supervisor. Supervision does not infer constant oversight; a NEBB Qualified Technician is capable of performing assigned tasks with periodic supervision.
10. Precision: Ability of an instrument to produce repeatable readings of the same quantity, or a tightly grouped set of values, under the same conditions.
11. Range: Upper and lower limits on an instrument's ability to measure the value of a quantity for which the instrument is calibrated.
12. Resolution: Smallest change in a measured variable that an instrument can detect.
13. Testing: Use of specialized and calibrated instruments to measure temperatures, pressures, rotational speeds, electrical characteristics, velocities, and air and hydronic quantities for an evaluation of flow conditions.
14. Testing and Balancing: As used in these specifications, testing and balancing refers to testing, adjusting, and balancing (TAB) as described in the above references.
15. TAB: A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as "Testing, Adjusting, and Balancing" and are described in this document.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: This section describes specific requirements, products and methods of execution for the testing, adjusting and balancing of the project.
- B. Performance Requirements: Furnish the services of a qualified and approved TAB Firm to perform the work of this specification section.
- C. The work of this section includes but is not necessarily limited to:
 1. Test and balance fans and supply, exhaust, and relief ventilating systems.
 2. Test and balance hydronic heating systems.
 3. Test and balance domestic hot water recirculation flow rate.
 4. Test and balance room air pressure relationships.
 5. Work directly with the control subcontractor to obtain proper system adjustments. This includes, but is not limited to:
 - a. VAV, RAV, EAV box controller airflow coefficient adjustments.
 - b. Airflow measuring device calibration adjustments.
 - c. Fluid flow measuring device calibration adjustments.
 6. Measure sound power levels if so directed.
 7. Provide a final report.

- D. The work of this section does not include:
 - 1. Adjusting burners for proper combustion operation.
 - 2. Liquid waste transfer system adjustment.
 - 3. Refrigeration work.
 - 4. Control system adjustments, unless noted otherwise herein.

1.4 PRE-BALANCING MEETING

- A. Coordinate TAB work with other trades and requirements of other related sections of the Project Manual prior to commencing work.
- B. Schedule a pre-balancing meeting one week prior to commencing work of this Section. Refer to Section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data: Sample report forms and outlines indicating adjusting, balancing, and equipment data required prior to commencing work.
- C. Certificates:
 - 1. Submit the name and qualifications of TAB Firm for approval with general product submittals. Submit copy of TAB Firm's NEBB certification.
 - 2. Submit the names and certifications of the Firm's NEBB Qualified TAB Supervisor and NEBB Certified Technician.
- D. Balancing Report:
 - 1. Submit a complete report of the testing and balancing of all devices in a format equivalent to that shown in the SMACNA HVAC Systems Testing, Adjusting and Balancing manual. Compile the test data and submit eight copies of the complete test data for acceptance and/or analysis and recommendations.
 - 2. Provide report in soft cover, letter size, comb bound binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include drawings within report.
 - 3. Report Cover Sheet. Include the following data:
 - a. Project Name.
 - b. Project Address.
 - c. Names of Architect and Engineer.
 - d. Names of General Contractor and HVAC Contractor.
 - e. Report date.
 - f. Names of TAB technicians responsible for the measurements and report.
 - 4. System Review Sheet:
 - a. List air and hydronic systems balanced, with systems highlighted that were found to be performing outside design tolerances.
 - b. Include a summary of problems encountered, deviations from design, deficiencies in performance, remaining problems, recommendations, and comments.
 - 5. Instrument Calibration Report:
 - a. Include a complete list of test equipment used, including apparatus manufacturer's name, model number, serial number, and date last calibrated.

- b. List the instruments used on the project during the balancing work, on a NEBB “Instrument Calibration Report” form, or equivalent form. This includes flow measuring hoods and other related devices.
6. Air Systems Report: Prepare a report for each air system balanced. Tabulate data separately for each system. Describe balancing method used for each system. At minimum, include the following:
 - a. System Diagram: Include locations of air terminal units and pitot tube traverses. Include appropriate notes, static pressure reading locations, etc., taken during testing and balancing.
 - b. Air Apparatus or Fan Test Report: Include pertinent data on the test report forms. If test data could not be measured, or is not applicable, indicate such on report forms. List how each actual cfm measurement was obtained (duct traverse, total of outlet airflows, or a combination).
 - c. Duct Pitot Tube Traverse Reports: Include actual temperature and pressure readings recorded at the time of testing and balancing.
 - d. Air Outlet Test Reports: Include applicable A_k factors and terminal device sizes. If flow measuring hoods are used, indicate their use in the remarks column.
 - e. Include complete identification of elements. Identify by box number, room name and number, air outlet symbol, orientation in room, etc., as necessary to clearly and positively identify the location of each element.
7. Hydronic Heating System Reports. Prepare a report for each hydronic system balanced. Tabulate data separately for each system. Describe balancing method used for each system. At minimum, include the following:
 - a. Schematic Diagram: Include heat exchange equipment and locations of flow measuring devices.
 - b. Pump Test Report: Confirm test data was recorded and properly entered on form. Attach manufacturer’s pump capacity curves, with the actual pump operating point plotted, to the test report form. List how the actual pump flow rate was determined (flow meter, pump curve, etc.).
 - c. Primary Heat Exchange Equipment: Confirm that appropriate test data has been recorded for the boilers, heat exchangers, chillers, and other primary heat exchange equipment. List how the actual flow rate(s) of each item was determined.
 - d. Terminal Heat Exchange Equipment: Confirm that heating coil and terminal unit temperatures and pressures were recorded and properly entered on form. List how each terminal unit flow rate was determined.
 - e. Include complete identification of elements. Identify by equipment tag number, room name and number, baseboard symbol, orientation in room, etc., as necessary to clearly and positively identify the location of each element.
8. Reduced Size Drawings: Provide with air outlets and equipment identified to correspond with data sheets. Record actual locations of thermostats, flow measuring stations, and balancing valves with settings.
9. Reduced Sized Pressure Maps and/or Environmental Drawings: Provide marked up record drawings, recording actual room by room airflows, pressure relationships, and /or equipment offsets as indicated on contract drawings.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. The work described in this section shall be performed by a Firm certified by the National Environmental Balancing Bureau for air and hydronic balancing.

2. The Firm shall have a record of operation within Alaska for at least three years prior to bid date of this project and shall have demonstrated satisfactory completion of five projects of similar size and scope in the State of Alaska. Provide references if requested.
 3. The Firm's Technician and Supervisor for this project shall be NEBB certified for their respective positions.
 4. Bids by suppliers, contractors or any Firm whose principal business is not that of testing, adjusting, and balancing HVAC systems are not acceptable.
- B. Balancing Standards:
1. Perform total system balance in accordance with NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
 2. Maintain one copy of balancing procedural document on site.
 3. Use standard NEBB forms.
- C. Timing of Work:
1. Sequence work to commence after completion of systems. Do not begin balancing and testing until the systems are complete and in full working order.
 2. Schedule the testing and balancing work in cooperation with other trades.
 3. Schedule completion of testing and balancing before Substantial Completion of Project.
- D. Construction team responsibility to TAB Agency: Refer to 200000 - Mechanical General Conditions.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL SUMMARY OF BALANCING WORK

- A. Provide TAB for the systems and equipment revised under this project including, but not limited to:
1. Existing AHU revised minimum outside air percentages.
 2. Existing AHU-1 and AHU-2 airflow balancing to accommodate revised performance points.
 3. Existing and new AHU heating coils revised flowrates and performance verification.
 4. Existing glycol heating loop serving AHU heating coils, including water to glycol heat exchanger and glycol circulation pumps.
 5. Hydronic balancing for revised and new terminal heating units and air terminal units.
 6. Hydronic heating system circulation pump balancing and revised performance verification.
 7. New exhaust fan systems for level 2 dental clinic and medical gas storage room.
 8. Existing, new, and revised exhaust air inlets, connected to existing exhaust fan systems, in the areas of work in basement and level 2.
 9. Existing, new, and revised supply air terminal units and air outlets in the areas of work in basement and level 2.
 10. Existing exhaust fans EF-5 serving basement garage area and EF-4 serving decontamination room. Rebalance to accommodate duct revisions and match original performance.
 11. Domestic hot water circulation system. Entire system to be rebalanced to accommodate project revisions.

12. Provide room pressure measurements for the following spaces:
 - a. Closed dental treatment rooms (rooms designed to be negative pressure).
 - b. Sterile supply/Hygiene Supply (room designed to be positive pressure).
 - c. Lab (room designed to be negative pressure).

B. Commissioning Support:

1. TAB Agency shall provide support for commissioning services including office and field support; refer to Section 019100 Commissioning. TAB Agency shall provide commissioning support for field support for verification/spot checking of TAB report values and commissioning field adjustments. Upon completion of commissioning activities, TAB Agency shall provide an updated and final TAB report incorporating any field adjustments during commissioning.

3.2 EXAMINATION

- A. Verify systems are complete and operable before commencing work.
- B. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- C. Report defects and deficiencies that may preclude proper TAB of systems and equipment.

3.3 PREPARATION

- A. Schedule work under the provisions of Section 200000 - Mechanical General Conditions.
- B. Provide calibrated instruments required for testing, adjusting, and balancing operations.
- C. Prior to starting work, review drawings and actual field conditions for additional balancing devices or components required for correct balance. Coordinate provision of additional balancing devices as required elsewhere in these specifications. Refer to Related Sections above.
- D. Preliminarily adjust grille, register, and diffuser blades or pattern controllers per drawings. If airflow blow patterns are not shown on drawings, adjust for uniform diffusion pattern(s) or diffusion into long dimension of room.

3.4 SPECIAL TECHNIQUES:

- A. Use instrumentation in accordance with NEBB requirements, calibrated to the accuracy standards specified by this organization.
- B. Flow measuring hoods are acceptable for measurement of ceiling diffuser performance if used in a manner as recommended by the manufacturer and calibration and accuracy data is provided with the balancing report.
- C. Upon request, make available to the Contracting Agency copies of current calibration certificates.

3.5 ACCEPTABLE CRITERIA

- A. Systems will be considered balanced in accordance with NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems* when the following conditions are satisfied:
1. Air Handling Systems:
 - a. Measured airflow quantities are within plus or minus 10 percent of design quantities. Deficiencies shall be noted in the TAB report.
 - b. There is at least one direct path with fully open dampers from the fan or terminal unit device to an air inlet or outlet. Additionally, if a system contains branch dampers, there will be at least one wide open path downstream of every adjusted branch damper.
 2. Air Outlets and Inlets:
 - a. Measured airflow quantities total to within plus or minus 10 percent of design to space and individual outlets and inlets in space to within plus or minus 10 percent of design.
 - b. Grilles, registers, and diffusers blades or pattern controllers are adjusted for uniform diffusion in the space. Re-adjust airflow patterns that result in airflow velocities greater than 50 FPM (feet per minute) at 5 feet above finish floor (AFF).
 3. Hydronic Systems:
 - a. Manually balanced systems:
 - 1). Measured fluid flow quantities are within plus or minus 10 percent of design.
 - 2). There is at least on direct path with fully open balancing valves from the pump discharge balancing valve (if present) to a terminal device. Additionally, if a system contains branch balancing valves, there will be at least one wide open path downstream of every adjusted branch balancing valve.
 - b. Automatically balanced systems: Pressure drops across a sample of system's automatic balance valves are within the manufacturer's recommended operating range for the device.
- B. If systems or components cannot be adjusted to within specified tolerances:
1. Coordinate the replacement of sheaves, belts, or other components or devices needed for correct balance as required elsewhere in these specifications.
 2. Note deficiencies in the TAB report.

3.6 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on equipment sheaves, belts, dampers, valves, air outlets and inlets and each system according to the procedures contained in the current edition of the NEBB *Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems* and this section.
- B. Adjustments shall be made with air handler filters blanked off to create a filter pressure drop of 60 percent of the manufacturer's recommended filter final pressure. Where multiple filters are encountered each set shall be individually blanked off, for a cumulated pressure drop of 60 percent of each filters final pressure.
- C. Ensure recorded data represents actual measured or observed conditions.

- D. Permanently mark final settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Contracting Agency.
- H. Schedule and provide assistance in final adjustment and test of fire alarm system with Authority Having Jurisdiction.

3.7 SITE QUALITY CONTROL

- A. Make calibrated test instruments available to Contracting Agency to facilitate spot checks during testing and commissioning as appropriate.
- B. Re-balance components or systems found to be out of tolerance at no additional expense to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for:
 - a. Hydronic heating piping.
 - b. Equipment drains and overflows.
2. Piping accessories.
3. Flexible pipe connectors.
4. Hydronic Specialties:
 - a. Air vents.
 - b. Strainers.
 - c. Flow indicators, controls, meters.
 - d. Flushing agents.
 - e. Water treatment chemicals.
 - f. Glycol specialties.
 - g. Heating coil.

B. Related Sections:

1. 200000 - Mechanical General Requirements
2. 200529 - Mechanical Hangers and Supports
3. 200548 - Mechanical Vibration and Seismic Control
4. 200553 - Mechanical Identification
5. 200700 - Mechanical Insulation
6. 230593 - Testing, Adjusting and Balancing
7. 233600 - Air Terminal Units
8. 238200 - Terminal Heating Units
9. 255000 - Building Automation System
10. 259000 - Sequence of Operations

1.2 REFERENCES

A. Codes and Standards:

1. See section 200000 - Mechanical General Requirements.
2. ANSI/ASHRAE/IEA Standard 90.1-2022 Energy Standard for Buildings Except Low-Rise Residential Buildings.
3. ASME Boilers and Pressure Vessel Code (1998), Sections IV & VI.

B. Abbreviations, Acronyms and Definitions:

1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
2. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. This section describes specific requirements, products, and methods of execution for the system of liquid heat transfer throughout the project. The system of heat generation is specified elsewhere.
2. Design expansion compensation system to adequately protect piping and structure from thermal expansion and contraction forces.

B. Performance Requirements:

1. Provide performance and output shown or scheduled on drawings.
2. Provide loops, pipe offsets, and swing joints, or expansion joints where required or indicated.
3. Pipes shall be capable of thermal expansion movement without disengagement of supports or forces on equipment connections.
4. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
5. Expansion Calculations:
 - a. Installation Temperature: 40 degrees F.
 - b. Hot Water Heating: 210 degrees F.
 - c. Domestic Hot Water: 140 degrees F.
 - d. Safety Factor: 30 percent.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See Section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.

B. Product Data:

1. Submit product literature for items specified in Part 2 and those products required by the performance standards of this section. Literature clearly annotated to indicate specified salient features and performance criteria.
2. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
3. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
4. Submit selection calculations for expansion joints and compensators.
5. Design Data: Submit calculations for performance specified products and systems.

C. Shop Drawings:

1. Submit shop drawings for performance-specified products and systems.
2. Submit shop drawings for piping systems to demonstrate proper layout and coordination.
3. Provide shop drawings to show system layout with location and detail of flexible pipe connectors and expansion joints.

4. Indicate elevation of piping above finish floor.
5. Indicate dimensions and weights of equipment, and placement of openings and holes.
6. Include reference to ductwork and other equipment where space coordination is necessary to avoid conflicts.
7. Indicate mechanical and electrical service locations and requirements.

D. Manufacturer Reports:

1. Certificates, Manufacturer's Instructions, and Manufacturer's Field Reports:
 - a. Provide a complete manufacturer's written installation, operation and maintenance manual for each type of installed equipment. Annotate the manual to indicate applicable information for the specific equipment model(s) installed.
 - b. Included with the manual one copy of the completed start-up and operation checklist. The checklist shall include:
 - 1). Printed names and signatures of the installers.
 - 2). Documentation from Manufacturer's representative and Contracting Agency that the equipment has been properly installed and is fully operational, thus validating the equipment warranty.
2. Test reports:
 - a. Provide certificate that cleaning of hydronic systems has been accomplished.
 - b. Provide certificate listing satisfactory results for the hydrostatic pressure tests.
 - c. Provide certificate listing satisfactory results for the operational tests.
3. Submit a letter to document that the training was conducted. Include in the letter the date, start/stop times for the training, list of attendees and signature/title of the person(s) providing the training.

- E. Quality Control Submittals: Refer to Section 019100 - Commissioning for submittal requirements.

1.6 CLOSEOUT SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.
- B. Operation and Maintenance (IO&M) Manuals:
1. Refer to Section 200000 - Mechanical General Requirements, for IO&M Manual formatting requirements and number of copies required.
 2. Include the following:
 - a. Copies of approved submittal information.
 - b. Manufacturer's installation, operating and maintenance/repair instructions, parts listings, and spare parts list for each product. Annotate the manual to indicate applicable information for the specific equipment model(s) installed.
 - c. Computer software manuals and applicable licenses.
 - d. Completed start-up and operational test report as required to validate equipment warranty.
 - e. Start-up and operational test reports for each piece of equipment. Report shall include printed names and signatures of the installers and documentation that the equipment has been properly installed and is fully operational, thus validating the equipment warranty.
- C. Record Documentation: Record actual locations of equipment, valves, strainers, air vents, flexible pipe connectors, expansion joints, other components, and locations of access doors

required for maintenance access in accordance with Section 200000 - Mechanical General Requirements.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.10 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements, for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Water Systems:
 - 1. Copper pipe three inches and smaller:
 - a. Type L copper, wrought copper fittings.
 - b. Fit joints using 430 silver solder, 95-5 tin-antimony or other approved lead-free solder. Solder type must be compatible with pipe and fittings. Solder containing lead shall not be allowed on the job site.
 - c. Soldering flux: Water flushable, low corrosivity type meeting the requirements of ASTM B813. Flux shall have label indicating it meets these requirements.
 - 2. Steel pipe four inches and larger: Welded pipe and fittings.
 - a. Grade B, seamless, ASTM A53 or A106.
 - b. Schedule 40 black with ANSI B16 butt weld fittings of type and wall thickness to suit pipe.
 - 3. Galvanized piping is not permitted.
- B. Glycol Systems (Copper or Steel Option):
 - 1. Copper pipe three inches and smaller:
 - a. Type L copper, wrought copper fittings.
 - b. Fit joints using 430 silver solder, 95-5 tin-antimony or other approved lead-free solder. Solder type must be compatible with pipe and fittings. Solder containing lead shall not be allowed on the job site.
 - c. Soldering flux: Water flushable, low corrosivity type meeting the requirements of ASTM B813. Flux shall have label indicating it meets these requirements.
 - 2. Steel pipe four inches and larger: Welded pipe and fittings. No threaded pipe allowed.
 - a. Grade B, seamless, ASTM A53 or A106.
 - b. Schedule 40 black with ANSI B16 butt weld fittings of type and wall thickness to suit pipe.

3. Galvanized piping is not permitted.

C. Copper Press Fitting System:

1. Limited to tubing sizes 4 inch and smaller.
2. Cast or wrought copper fittings, ASME B16.18 or ASME B16.22. Pre-formed grooves with pre-lubricated EPDM O-rings designed to seal fitting to copper tubing water tight with the use of manufacturer's crimping tool. Fittings shall be rated for 250 Degrees F., and 200 psi.
3. IAPMO UPC listing.
4. Manufacturer: Viega ProPress, NIBCO Press System, no substitutions.

D. Equipment drains and overflows: Type L copper pipe, wrought copper fittings.

2.2 VALVES

A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 PSIG saturated steam or 200 PSIG WOG. Packing material or seals shall not contain asbestos.

B. Manufacturers: Crane, Nibco, Hammond, Jenkins, Grinnell, Milwaukee, Stockham.

C. Ball Valves 2 inch and smaller: Two piece type, full port, bronze body and silicone bronze ball or chrome plated brass ball, TFE seats, blowout proof stem, 150 PSIG pressure/temperature rating (steam).

D. Ball Valves 2-1/2 inches through 4 inch: Two piece type, full port, bronze body and silicone bronze ball or chrome plated brass ball, TFE seats, 150 PSIG pressure/temperature rating (steam). May be substituted for gate valves except where otherwise indicated.

E. Drain Valves: Full port ball valve with threaded hose adapter with bronze end cap. Do not use sillcocks or butterfly valves as drain valves.

F. Valves Specified Elsewhere: Provide special valves such as motor-operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.

2.3 UNIONS (STANDARD)

A. Steel Piping (Threaded):

1. Class 150 malleable iron, ground joint, copper or copper alloy seat. Grinnell No. 463. (150 PSIG steam, 300 PSIG WOG).
2. Where indicated: Class 250 malleable iron ground joint, copper or copper alloy seat. Grinnell No. 554.

B. Copper Piping (Sweat and Threaded): Cast brass, ground joint, copper to copper, or copper to threaded joint. Grinnell No. 9730 - 9739.

2.4 DIELECTRIC ISOLATORS (ELECTRICALLY INSULATING)

A. Provide dielectric unions for two inch pipe and smaller.

- B. Provide dielectric flanges for 2-1/2 inch pipe and larger.
- C. Insulating gaskets shall be suitable for fluid type, temperature and pressure.
- D. Galvanized pipe to copper: Brass threaded end and sweat copper end.
- E. Black steel to copper: Zinc plated steel threaded end and sweat copper end.
- F. Manufacturers: Capitol, Epcu, Control Plastics, Watts, or approved equal.

2.5 PRESSURE GAUGES

- A. Provide where shown on drawings, specified in Part 3, or as required.
- B. Bourdon tube type with 4-1/2-inch dial (minimum) accuracy plus or minus one-percent span, recalibratable. Normal operating pressure near midpoint of range. Industrial quality.
- C. Gauge cock on gauges and pulsation damper (snubber). Steam gauges shall have siphon to isolate gauge from steam, except where remotely mounted and connected by looped tubing.
- D. Differential pressure gauges shall be piston or diaphragm type with range suitable for application and static pressure capability suitable for system pressure. Orange Research.

2.6 THERMOMETERS

- A. Provide where shown on drawings, specified in Part 3, or as required.
- B. Liquid in glass type: Industrial quality blue-reading with nine-inch scale length (minimum). Straight angle or adjustable as necessary for visibility. Trerice, Marsh, Weksler, or approved equal.
- C. Dial Type: Industrial quality three-inch dial with a 270 degrees (minimum) scale. Straight, angle or remote as necessary for visibility. Trerice, Marsh, Weksler, or approved equal.
- D. Digital, self-powered type: Weiss DVU or equal.
- E. Normal operating temperature at scale midpoint and sufficient range to cover operating conditions.
- F. Provide separable wells of suitable material for piping and mounting hardware for ducts. Set probe in heat transfer paste recommended by thermometer manufacturer.

2.7 PRESSURE AND TEMPERATURE TEST PLUGS

- A. Provide where shown on drawings, specified in Part 3 or as required.
- B. Standard type for 1/8-inch diameter pressure or temperature probes. Self seal when probe removed and complete with threaded cap. Minimum continuous rating 125 PSIG and 220 degrees F coincident. Sealing element suitable for fluid in pipe.
- C. Provide one thermometer and one pressure gauge for each range required by system parameters.

- D. Manufacturers: Sisco, Peterson Equipment, or approved equal.

2.8 FLEXIBLE PIPE CONNECTORS

A. General:

1. System Application: Hot water heating or 50 percent propylene glycol solution (heating).
2. System Maximum Operating Temperature: 210 degrees F.
3. Pressure: Internal.
4. Installation: Straight or Offset as shown.
5. Movement: Constant or Intermittent.
6. Maximum offset: Not to exceed 25 percent of the centerline bend radius.
7. Determine appropriate minimum "live hose length" (flexible portion of assembly) based on the centerline bend radius for each application in accordance with manufacturer's sizing tables.

B. Copper Pipe Flexible Connectors - Small Diameter (Sweat):

1. Size: 3/4 inch through 2-1/2 inch nominal pipe size (NPS).
2. Pipe Ends: Copper tube sweat.
3. Corrugated Hose: Bronze.
4. Outer Braid: Single braided bronze.
5. Minimum Working Pressure Rating: 120 PSIG at 250 degrees F.
6. Maximum Temperature Rating: 250 degrees F.

C. Copper Pipe Flexible Connectors - Small Diameter (Removable):

1. Size: 3/4 inch through 2-1/2 inch nominal pipe size (NPS).
2. Pipe Ends: Female pipe coupling, Female union, Male Hex Nipple, Male Pipe with Hex Nut.
3. Corrugated Hose: Bronze.
4. Outer Braid: Single braided bronze.
5. Minimum Working Pressure Rating: 120 PSIG at 250 degrees F.
6. Maximum Temperature Rating: 250 degrees F.

D. Steel Pipe Flexible Connectors - Small Diameter (welded):

1. Size: 3/4 inch through 2-1/2 inch nominal pipe size (NPS).
2. Pipe Ends: Weld nipple.
3. Corrugated Hose: Bronze.
4. Outer Braid: Single braided bronze.
5. Minimum Working Pressure Rating: 300 PSIG at 250 degrees F.
6. Maximum Temperature Rating: 250 degrees F.

E. Steel Pipe Flexible Connectors - Small Diameter (Removable):

1. Size: 3/4 inch through 2-1/2 inch nominal pipe size (NPS).
2. Pipe Ends: Schedule 40 steel with male pipe thread (MPT).
3. Corrugated Hose: Bronze.
4. Outer Braid: Single braided bronze.
5. Minimum Working Pressure Rating: 300 PSIG at 250 degrees F.
6. Maximum Temperature Rating: 250 degrees F.

- F. Manufacturers: Metraflex, Keflex, or equal.

2.9 AIR VENTS

- A. Coin operated vent: Manual low profile vent for use in baseboard and other enclosures where automatic vent will not fit. 150 PSIG working pressure, 212 degrees F. operating temperature. Bell & Gossett No. 4V or approved equal.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
 - 2. Iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
 - 3. Operating pressure 75 PSIG, hydrostatic pressure 200 PSI maximum, intended for use in hot or cold lines. Provide ball type isolation valves for air vents that do not have integral shut off valves.
 - 4. Manufacturers: Spirotherm Spirotop, Honeywell EA791004, or equal.
- C. Disc Type:
 - 1. Designed to be replaced without removal from line, with built-in check valve.
 - 2. Limited to baseboard, unit ventilators, cabinet unit heaters, convectors, and elsewhere where air vent must be installed in a cabinet or enclosure, unless other type detailed on drawings.
 - 3. Maximum working pressure: 50 PSIG.
 - 4. Manufacturer: Hoffman No. 500, or equal.

2.10 STRAINERS

- A. Size two inch and under:
 - 1. Screwed brass or iron body for 175 PSIG working pressure.
 - 2. Y pattern with 1/32-inch stainless steel perforated screen.
- B. Size 2-1/2 inches to four inches:
 - 1. Flanged or grooved iron body for 175 PSIG working pressure.
 - 2. Y pattern with 3/64-inch stainless steel perforated screen.
- C. Manufacturers: Metraflex, Armstrong, Crane, Hayward, Watts Regulator, Hoffman, Sarco.

2.11 AUTOMATIC FLOW LIMITING AND ISOLATION VALVES

- A. Supply pipe side: Brass alloy body with stainless steel flow cartridge assembly, integral ball valve, 20 mesh strainer element, two pressure/temperature test valves and drain valve with hose bibb adapter and end cap. Body design allows removal of flow cartridge without disturbing piping connections. Threaded sweat adapter inlet. Union with sweat adapter outlet.
- B. Return pipe side: Forged brass body with integral ball valve, pressure/temperature test valve and manual air vent. Union with sweat adapter inlet. Threaded sweat adapter outlet.
- C. Calibration: Control flow within five percent of selected rating, over operating pressure range of at least 10 times minimum pressure required for control. Provide three operating pressure ranges with a minimum range requiring less than 3.5 PSID to actuate flow control cartridge.

- D. Flow Control Cartridge: Stainless steel one piece cartridge with segmented port design and full travel linear coil spring.
- E. Provide supply and return components packaged as a system and labeled in accordance with the equipment schedule tag to match terminal heating unit served.
- F. Manufacturer: Griswold Controls, Bell & Gossett, or approved equal.

2.12 WATER TREATMENT

- A. Hydronic loop treatment manufacturer: CH2O, Product 6439 or approved equal.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Installer: Perform work by experienced personnel previously engaged in hydronic system construction and under the supervision of a qualified installation supervisor.

3.2 PREPARATION

- A. Protection of In-Place Conditions: Cover equipment and plug piping connections to protect components from construction dirt and debris.
- B. Surface Preparation:
 - 1. Prior to installation of equipment, verify concrete housekeeping pads are complete and properly sized for equipment mounting.
 - 2. Prior to installation of piping and equipment, verify that shop drawings are approved, and locations and routing have been coordinated with the work of other trades.

3.3 INSTALLATION

- A. Special Techniques:
 - 1. Install equipment in accordance with manufacturer's instructions and requirements of the codes specified herein.
 - 2. Provide finished products with protective covers during balance of construction.
 - 3. Provide accessible ball type isolation valves at major piping branches, and on main lines as shown, and at terminal devices. Provide drains and manual vents at main line and branch line valves to facilitate draining and filling piping sections. Provide caps on drain outlets.
 - 4. Access Doors: Provide appropriate size and install such that hydronic system features are readily accessible and maintainable.
 - 5. Install balancing valves and automatic flow limiting valves to be accessible and adjustable.
 - 6. Install piping to maintain headroom, conserve space, and not interfere with use of space.
 - 7. Use of bullhead tee with opposed flow, double inlet configuration not allowed.
 - 8. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 9. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - 10. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 9 - Finishes.

11. Thermal Expansion:
 - a. Install piping to allow for normal thermal expansion and contraction without stressing pipe, joints, or connected equipment.
 - b. Provide anchors where necessary and as shown.
 - c. Provide support and expansion loops, expansion compensators, and alignment guides to suit conditions and as shown on drawings.
 - d. Piping shall be guided and restrained as recommended by the manufacturer.
 12. Provide test plugs on both inlet and outlet sides of heat transfer elements to allow measurement of both fluid pressure drop and differential temperature.
 13. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
 14. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor the other end. Install in horizontal plane unless indicated otherwise.
 15. Provide pipe anchors, offsets, loops and expansion compensators as required to control the expansion of pipelines.
 16. Flushing:
 - a. Where hydronic piping installed under this project is connected to an existing hydronic system, provide branch isolation valves and provision for cleaning and flushing consisting of tees with valve, hose fittings and caps immediately adjacent to the branch isolation valves.
 - b. Clean internal surfaces of the completed heating system in the level 2 areas of work as follows:
 - 1). Flush hydronic piping to remove black magnetic iron oxide and mill scale from the system.
 - 2). Repeat process until the system is clean to the satisfaction of the Contracting Agency.
 - 3). Exercise proper care during flushing and cleaning of systems to make sure no damage is done to equipment, valves, fittings, or Work of other trades. Restore damaged system components or Work of other trades to new or original condition at no additional cost to Owner.
- B. Interface with Other Work: Coordinate and sequence installation of hydronic products with trades responsible for portions of this and other related sections of the Project Manual.

3.4 REPAIR/RESTORATION

- A. Repair any product components broken during installation or startup with replacement parts supplied by the product manufacturer.
- B. Substitute replacement parts from other manufacturers are not acceptable.
- C. Touch-up finished surfaces with touch-up paint provided by the equipment manufacturer.

3.5 SITE QUALITY CONTROL

- A. Non-Conforming Work: Rework required as a result of failure to follow the manufacturer's written installation instructions or to properly coordinate with related Work shall be completed at no additional expense to the Owner.

- B. Manufacturer Services:
1. Verify units are installed and operational in accordance with the manufacturer's written installation instructions.
 2. Both the Contractor and Manufacturer's Representative(s) shall sign start-up and operational checklist to confirm proper unit installation and operation.
 3. Provide samples of the inhibited propylene glycol solution to the manufacturer for testing using the fluid analysis test kit provided.
 4. The manufacturer of the inhibited propylene glycol solution shall provide free testing of the solution 24 hours after system startup and again 90 days later to verify proper fluid performance for both tests.
 5. Provide one copy of manufacturer's test reports to the Owner. Adjust fluid concentration and/or correct deficiencies as addressed in the report.
- C. System fill:
1. After flush cleaning the hydronic heating system, fill the primary system with water and add treatment chemicals to the concentration recommended by the manufacturer. Fill the secondary loop system with inhibited propylene glycol solution as specified.
 2. Thoroughly vent the systems to include piping high points and equipment vents (pump casings, air separators, etc.).
- D. Site Tests:
1. Hydrostatic Pressure Test:
 - a. Make sure hydronic heating systems are filled with clean operating fluid. Hydrostatically test new piping in areas of work to 100 PSIG. System must hold test pressure for a two hour period with no pressure drop to pass test.
 - b. Inspect system during test and repair leaks.
 - c. Provide written report indicating that the pressure test has been satisfactorily completed.
 2. Operational Test:
 - a. Inspect system for proper fluid circulation, sufficient clearance for expansion and contraction of piping and proper system pressure control.
 - b. Note and correct discrepancies and deficiencies.
 - c. Provide written report indicating that the operational test has been satisfactorily completed.
 3. Test results shall be certified in writing as required by General Conditions. Include dates and sections tested, test pressure, test duration, printed names and signatures of person performing the test and Contracting Agency witnessing the test.
- E. Inspection:
1. Arrange for inspections and provide written notice to the Contracting Agency when the entire work or logical portions thereof, is ready for inspection.
- F. Verify penetrations are installed to maintain assembly integrity.

3.6 SYSTEM STARTUP

- A. Start-up and operate hydronic heating systems and equipment in accordance with the manufacturer's written installation and operation manual checklist.
- B. Document start-up and operational checks using the checklist and submit in accordance with submittal requirements.

3.7 ADJUSTING

- A. Adjust functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.
- B. Coordinate and work directly with the Balancing and Testing Agency and the requirements of Section 230593 - Testing, Adjusting and Balancing, to provide systems in proper operating order.
- C. Make corrections and adjustments as required by the Testing, Adjusting and Balancing (TAB) Agency in a timely manner.

3.8 CLEANING

- A. Waste Management: After construction is completed, clean and wipe down exposed surfaces of pumps, piping and appurtenances.

3.9 CLOSEOUT ACTIVITIES

- A. Demonstration: Provide 1 hour of demonstration conducted by authorized factory start-up personnel to the Contracting Agencies authorized maintenance personnel.
- B. Training: Provide 1 hour of operational instruction conducted by authorized factory start-up personnel to the Contracting Agencies authorized maintenance personnel.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal Ductwork and Fittings.
2. Flexible Ductwork.
3. Acoustical Linings.
4. Volume Dampers.
5. Control Dampers.
6. Smoke and Combination Fire/Smoke Dampers.
7. Fire Dampers.
8. Gravity Backdraft Dampers.
9. Flexible Duct Connectors.
10. Access Panels and Doors.

B. Related Sections:

1. 019100 - Commissioning
2. 200000 - Mechanical General Requirements
3. 200529 - Mechanical Hangers and Supports
4. 200548 - Mechanical Vibration and Seismic Control
5. 200700 - Mechanical Insulation
6. 230593 - Testing, Adjusting and Balancing
7. 233400 - HVAC Fans
8. 233600 - Air Terminal Units
9. 233700 - Air Outlets and Inlets
10. Division 28 - Electrical

1.2 REFERENCES

A. Codes and Standards:

1. See section 200000 - Mechanical General Requirements.
2. ASHRAE Standard 90.1-2022 Energy Standard for Buildings Except Low-Rise Residential Buildings.
3. SMACNA HVAC Duct Construction Standards - Metal and Flexible, Third Edition 2005.
4. SMACNA HVAC Air Duct Leakage Test Manual, Second Edition 2012.
5. SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, Fifth Edition 2002.
6. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
7. ACR the National Air Duct Cleaners Association (NADCA) Standard for Assessment, Cleaning and Restoration of HVAC Systems, 2013.

1.3 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.4 SUBMITTALS

- A. See section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data: Include manufacturer's detailed fire, smoke, and combination fire/smoke damper installation instructions for each specific wall, ceiling, and floor construction type(s) for the project.
- C. Shop Drawings:
 - 1. Include the following information in the scaled ventilation system shop drawings:
 - a. Label duct sizes using the same labeling method as the Contract Documents.
 - b. Show terminal equipment ductwork connections.
 - c. Volume, control, backdraft, fire, smoke, and combination fire/smoke damper locations as applicable.
 - d. Flexible connection locations.
 - e. Access panels and doors with sizes and swing directions shown.
 - 2. Casings and plenums: Submit detailed shop drawings showing the proposed plenum and casing materials to be used and the construction method.
- D. Test and Evaluation Reports:
 - 1. Provide written certification to the Contracting Agency that smoke and combination fire/smoke dampers have been operationally tested and function in accordance with Section 283100 - Addressable Fire Alarm sequences of operation.
- E. Installation, Operation and Maintenance (IO&M) Manuals.

1.5 CLOSEOUT SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.
- B. Record Documentation: Record actual locations of ductwork and areas required for maintenance access in accordance with Section 200000 - Mechanical General Requirements.

1.6 QUALITY ASSURANCE

- A. See section 200000 - Mechanical General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.8 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements, for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 METAL DUCTWORK AND FITTINGS

- A. General: Provide metal ductwork and fittings fabricated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, G90 zinc coated unless otherwise noted.
- B. Medium Pressure/Velocity Ductwork:
 - 1. Duct Pressure Class: 6 inches WC.
 - 2. Seal Class: A.
 - 3. Maximum Velocity: 2,200 FPM.
- C. Low Pressure/Velocity Ductwork:
 - 1. Duct Pressure Class: 2 inches WC.
 - 2. Seal Class: A.
 - 3. Maximum Velocity: 1,500 FPM.

2.2 FLEXIBLE DUCTWORK

- A. Manufacturers:
 - 1. Thermaflex, Model M-KE.
 - 2. Hart & Cooley.
 - 3. JPL.
 - 4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Description: UL listed, Class 1 flexible ductwork in compliance with NFPA 90A and 90B.
- C. Performance/Design Criteria:
 - 1. Positive Pressure Rating:

Ten inches WC	(4"-12" ID).
Six inches WC	(14"-16" ID).
Four inches WC	(18"-20" ID).

- 2. Negative Pressure Rating:

One inch WC	(4"-12" ID).
One half inch WC	(14"-20" ID).

- 3. Maximum Velocity: 5000 FPM.
- 4. Operating Temperature Range:
 - a. 0 degrees F to 140 degrees F (continuous).
 - b. Minus 20 degrees F to 250 degrees F (intermittent).
- 5. Insulating Value: R-4.2.

- D. Materials:
 - 1. Acoustically rated black polyester core permanently bonded to coated spring steel wire helix.

2. Fiberglass insulation.
3. Tear resistant, reinforced metalized vapor barrier.

2.3 ACOUSTICAL LININGS

- A. Manufacturers:
1. Knauf.
 2. Johns Manville.
 3. Owens-Corning.
 4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Description:
1. UL listed.
 2. NFPA 90A and 90B compliant.
 3. One inch thick, 1.5 PCF, flexible, edge-coated, mat-faced glass fiber insulation bonded with thermosetting resin.
 4. Does not promote growth of fungi or bacteria.
- C. Performance/Design Criteria:
1. Maximum Velocity: 6000 FPM.
 2. Operating Temperature Range: Up to 250 degrees F.
 3. Maximum Water Vapor Sorption: Three percent by weight.

2.4 VOLUME / BALANCING DAMPERS

- A. Manufacturers:
1. Ruskin.
 2. Greenheck.
 3. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Materials:
1. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for fabricated volume damper construction requirements.
 2. Round ducts to 12 inches diameter and rectangular to 18 inches width:
 - a. Flat sheet, galvanized steel, single blade damper.
 - b. Damper blade two gauges thicker than the duct gauge at the location installed (24 gauge minimum for round, 22 gauge minimum for rectangular).
 - c. Manual hand quadrant.
 3. Round ducts over 12 inches diameter:
 - a. Flat sheet, galvanized steel, single blade damper.
 - b. Damper blade two gauges thicker than the duct gauge at the location installed (22 gauge minimum).
 - c. Manual hand quadrant with continuous steel rod.
 4. Rectangular ducts over 18 inches width:
 - a. Flat sheet, galvanized steel, single blade damper.
 - b. Damper blade 18 gauge minimum.
 - c. Manual hand quadrant with continuous steel rod.
 5. Accessible and lockable damper operators.

- C. Extractors: Not Permitted.
- D. Splitter Dampers: Not Permitted.

2.5 REMOTE VOLUME DAMPER OPERATORS

- A. Manufacturers:
 - 1. Duro-dyne.
 - 2. Young Regulator.
 - 3. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Provide flush mounted chrome plated remote operators with tamperproof cover, extension rod, and not more than one 90 degree angle gear drive.
- C. Regulator: Duro-dyne Series SRC-380 or Young Regulator 301.
- D. Angle Drive: Duro-dyne Model AD-38 or Young Regulator 927.

2.6 CONTROL DAMPERS

- A. Manufacturers:
 - 1. Ruskin, Model CD50 (rectangular) or CDR25 (round).
 - 2. Greenheck, Model VCD-43 (rectangular).
 - 3. Air Balance.
 - 4. Pottorff.
 - 5. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Rectangular:
 - 1. Performance/Design Criteria:
 - a. Temperature Limits: -72 degrees F to 275 degrees F.
 - b. Capacity: Demonstrate capacity of damper to withstand HVAC system operating conditions.
 - 1). Closed Position: Maximum pressure of 13 inches WC at a 12-inch blade length.
 - 2). Open Position: Maximum air velocity of 6,000 feet per minute.
 - c. Leakage: Maximum 3.0 cubic feet per minute per square foot at 1.0 inch WC for sizes 24 inches wide and above.
 - d. Pressure Drop: Maximum 0.05 inches WC at 1,500 feet per minute across 24 inch by 24 inch damper.
 - 2. Material:
 - a. Frame: Five inches by one inch by minimum 0.125 inch 6063T5 extruded aluminum hat channel, mounting flanges on both sides of frame, reinforced at corners.
 - b. Blades: Airfoil-shaped, single-piece blades made of heavy-duty 6063T5 extruded aluminum. Maximum 6 inches blade depth.
 - c. Bearings: Non-corrosive, molded synthetic sleeve, turning in hole in frame.
 - d. Seals:
 - 1). Blade: Extruded vinyl type for ultra-low leakage. Mechanically attached to blade edge.
 - 2). Jamb: Flexible metal compressible.

- e. Linkage: Concealed in frame.
- f. Axles: Minimum 1/2-inch diameter plated steel hex, mechanically attached to blade.
3. Finishes: Mill aluminum.

C. Round:

1. Performance/Design Criteria:
 - a. Temperature Rating: Maximum 250 degrees F.
 - b. Capacity: Demonstrate capacity of damper to withstand HVAC system operating conditions.
 - c. Closed Position: Maximum pressure of 10 inches WC.
 - d. Maximum system velocity: 4,000 feet per minute.
 - e. Maximum Leakage: Maximum 6 cubic feet per minute per square foot at 1 inch WC.
 - f. Pressure Drop: Maximum 0.05 inch WC at air volume of 7,000 cubic feet per minute through 24 inch diameter damper.
2. Material:
 - a. Frame:
 - 1). Under 6 inches Diameter: Two inches by minimum 12 gauge galvanized steel tube.
 - 2). 6 through 12 inches Diameter: Two inches by 1/2-inch by minimum 14 gauge galvanized steel channel.
 - 3). Above 12 through 24 inches Diameter: Two inches by 1/2-inch by minimum 1/8-inch galvanized steel channel.
 - b. Blade: Provide single-piece construction made of the following material:
 - 1). 18 inches diameter and less: Minimum 12 gage galvanized steel.
 - 2). Over 18 inches diameter: Minimum 10 gage galvanized steel, stiffeners as required.
 - c. Blade Seals: Closed cell polyethylene foam rubber or neoprene, fully encompassing and mechanically attached to blade edge.
 - d. Bearings: Self-lubricating stainless steel sleeve.
 - e. Axles: Minimum 1/2-inch diameter plated steel, full length of and extending 6 inches beyond damper frame, mechanically attached to blade.
3. Finishes: Mill galvanized.

2.7 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
 1. Duro-dyne Corporation.
 2. Vent Fabrics.
 3. Ductmate.
 4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Performance/Design Criteria: Provide fan connectors with static pressure ratings suitable for each specific application. Minimum pressure ratings must be greater than, or equal to, the fan's shut-off static pressure, as indicated by the submitted fan curve, with a 50 percent safety factor.
- C. Materials:
 1. Metal edging: 24 gauge galvanized steel.
 2. Fabric: UL Listed, polyester blend with vinyl coating. Double folded seams. Four inches width.

2.8 ACCESS PANELS AND DOORS FOR DUCTS AND PLENUMS

- A. Manufacturers:
1. Air Balance Inc. model FSA-100 (Basis of Design).
 2. Ruskin.
 3. Ductmate.
 4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Material:
1. Frame and Door: Minimum 24 gauge galvanized steel.
 2. Reinforced doors with cross-bracing and/or otherwise stiffened to prevent rattling and vibration.
 3. Seals: Rubber gaskets, secured to door or frame.
 4. Where ductwork is insulated or lined, provide double-walled access door panels with one inch of internal insulation to match duct or plenum insulating and/or sound attenuating characteristics.
 5. Walk Through Doors:
 - a. Construct in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - b. Provide insulation and inner liner to match plenum or casing.
- C. Hinges and Latches:
1. Low velocity system access panels:
 - a. Sizes 12 inches by 12 inches through 24 inches by 24 inches.
 - b. Continuous steel hinge mechanically fastened to frame and quarter turn cam latches.
 2. Medium velocity system access panels:
 - a. Sizes 12 inches by 12 inches through 24 inches by 24 inches.
 - b. Continuous steel hinge mechanically fastened to frame.
 - c. Provide a minimum of two latches for rolled plate doors.
 - d. Cement sheet rubber gasket to door.
 3. Walk through doors (any dimension over 24 inches):
 - a. Provide three hinges.
 - b. Provide two latches with inside and outside handles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify location, size and type (i.e. fire resistive construction) of wall, floor and ceiling/roof penetrations.

3.2 PREPARATION

- A. Protection on In-Place Conditions: During construction, install temporary closures of sheet metal, cardboard or polyethylene taped over ductwork openings to prevent construction dust and debris from entering duct systems.

3.3 INSTALLATION

A. Metal Ductwork and Fittings:

1. Install, seal and support ductwork and fittings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible for the duct pressure class and seal class specified. The use of “duct tape” as a duct seal method is prohibited.
2. Provide medium pressure/velocity ductwork at the following locations: VAV ventilation systems from air handler cabinet discharge plenum connection to VAV terminal unit inlet neck connection.
3. Provide low pressure/velocity ductwork at the following locations:
 - a. VAV terminal unit discharge connections to air outlet connections.
 - b. Outside air intake ductwork.
 - c. Exhaust and relief air ductwork.
 - d. Constant volume ventilating systems.
4. Proprietary or other joint systems may be substituted for SMACNA details when submitted and approved in writing before starting work.
5. Where ducts penetrate through walls exposed in occupied spaces, provide sheet metal escutcheons at each penetration to provide a clean, finished appearance.
6. Duct penetrations: See Section 200529 - Mechanical Hangers and Supports.
7. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoffs, use 90-degree conical tee or low-loss tee connections.
8. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream of equipment.
9. Provide orifice plates or balance dampers at branch connections as required for proper ventilation system balancing. Select balancing device and installation method to limit noise from mechanical vibration or air bypass.
10. Do not use turning vanes in medium velocity duct systems.
11. Support duct mounted equipment equal to or greater than 40 pounds, such as heating coils, independently from ductwork.
12. Support duct mounted equipment less than 40 pounds using standard duct supports and sway bracing located within 12 inches of equipment.
13. Where offsetting ductwork is not possible, ducts may be reduced a maximum of 20 percent to clear obstacles with Contracting Agency’s permission.
14. Where steel ductwork is visible through air outlets or inlets, paint visible interior ductwork flat black.

B. Flexible Ductwork:

1. Install, connect and support flexible ductwork in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
2. Connection to air outlets in suspended grid ceiling systems: Provide a flexible duct length of 6 to 8 feet with one 90-degree bend or large radius 180-degree curve in addition to outlet connection. Support flexible duct at connections to air outlets to maintain minimum recommended bend radius.
3. Seal flexible duct connections to rigid ductwork with draw bands to the pressure class of the rigid duct system.
4. Flexible duct connections between medium pressure ductwork and air terminal units are prohibited.
5. Flexible ductwork is prohibited in inaccessible locations, such as above “hard” ceilings.
6. Flexible ductwork is prohibited at penetrations through walls.

- C. Acoustical Lined Ductwork:
1. Provide standard one inch thick acoustically lined ductwork as indicated using the acoustical liner material specified. Attach the lining material to the ductwork in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide thicker acoustical lining where specifically noted.
 2. Duct dimensions indicated are net free-area duct dimensions. Add twice the liner thickness to obtain outside duct dimensions.
 3. Sleeve acoustical duct penetrations through full height walls perpendicular to wall surface. Provide 1/2-inch minimum gap between sleeve and duct. Fill gap with mineral wool backer and seal each side of penetration with acoustical sealant.
- D. Volume Dampers:
1. Provide air volume dampers at each low-pressure duct main and branch take-off for proper air balancing.
 2. Locate dampers a minimum of 10 feet from diffusers except where shown otherwise.
 3. Volume dampers are not to be installed in medium pressure, variable air volume systems.
- E. Flexible Duct Connectors:
1. Install duct connectors in accordance with the manufacturers written installation instructions.
 2. Provide a flexible airtight joint between fans and other vibrating equipment and the air distribution ductwork systems.
 3. Externally isolated air handling units and fans: Provide flexible connections where ducts attach to unit inlet and outlet(s) of unit.
- F. Penetrations:
1. Coordinate mechanical penetrations with architectural and structural construction details prior to installation. Set sleeves in position in concrete formwork. Provide reinforcement around sleeves as required.
 2. Provide compatible materials, fasteners, adhesives, sealants, and other products required for proper installation.
 3. Penetrations through roof, exterior walls and floors to be weather and water tight.
 4. Penetrations through fire rated assemblies to be UL listed.
 5. Penetrations through smoke partitions and barriers to resist passage of smoke.
 6. Other penetrations to have acoustical seals.
- G. Access Panels and Doors:
1. Locate access doors to enable in-duct equipment to be easily inspected, cleaned, maintained and tested and/or reset.
 2. Provide access doors at the following locations:
 - a. Fire, smoke and combination fire/smoke dampers.
 - b. Motor operated dampers.
 - c. Each side of duct mounted coils.
 - d. As necessary for duct cleaning in accordance with NADCA Industry Standard for Mechanical Cleaning of Non-Porous Air Conveyance System Components.
 - e. As necessary for maintenance access to serviceable instrumentation and control equipment.
 3. Coordinate location and size of access doors in walls, partitions and ceilings to correspond with duct access doors, dampers and automatic control devices and instruments.

4. Coordinate with supplier of component air handlers, package units and similar equipment to ensure that access doors and panels will not be obstructed when the equipment is installed.

H. Interface with Other Work:

1. Assist electrical and controls trades in mounting instrumentation devices and safety controls in ductwork and air handling units.
2. Make penetrations through exterior building walls watertight. Detail ductwork connections to prevent condensation or leakage from entering into surrounding building construction. Provide sleeves, special connections and sealant as required to accomplish this performance requirement.

3.4 SITE QUALITY CONTROL

A. Site Tests and Inspections:

1. Smoke and Combination Fire/Smoke Dampers: Test automatic closure and reset of smoke and combination fire/smoke dampers in accordance with Section 283100 - Addressable Fire Alarm sequences of operation.

- B. Verify accessibility to ventilation system components for maintenance, adjustment and cleaning.

3.5 ADJUSTING

- A. Adjust and balance dampers in accordance with Section 230593 - Testing, Adjusting and Balancing.

3.6 CLEANING

- A. Prior to occupancy of areas of work and after ventilating systems are complete and functional, verify cleanliness of ventilating system ductwork. Verification shall comply with the inspection method(s) outlined in the National Air Duct Cleaners Association (NADCA) Standard for Assessment, Cleaning, and Restoration of HVAC Systems 2013. Conduct inspection in the presence of a Contracting Agency representative.

- B. If the ductwork does not comply with the standard for cleanliness, clean the affected ductwork as follows:

1. Small systems: Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient airflow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.
2. Large systems: Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Single duct variable air volume terminal units.
- B. Products Installed But Not Supplied Under This Section: Coordinate installation of damper control actuators and application specific controllers, furnished under Section 255000 - Building Automation System. Control enclosure shall be factory mounted by the air terminal unit manufacturer.
- C. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200529 - Mechanical Hangers and Supports
 - 3. 200548 - Mechanical Vibration and Seismic Control
 - 4. 200553 - Mechanical Identification
 - 5. 200700 - Mechanical Insulation
 - 6. 230131 - Duct Cleaning
 - 7. 230593 - Testing, Adjusting and Balancing
 - 8. 232113 - Hydronic Piping and Specialties
 - 9. 233100 - Ducts and Accessories
 - 10. 233700 - Air Outlets and Inlets
 - 11. 255000 - Building Automation System
 - 12. 259000 - Sequence of Operations
 - 13. Divisions 26, 27 and 28 - Electrical

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. SMACNA - HVAC Duct Construction Standards, Metal and Flexible, Third Edition 2005.
 - 3. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
 - 4. ANSI/AHRI 880-2011 - Performance Rating of Air Terminals.
- B. Abbreviations, Acronyms and Definitions:
 - 1. Refer to Division 01 for general abbreviations, acronyms, and definitions.
 - 2. Refer to Section 200000 - Mechanical General Requirements for general mechanical related definitions.
 - 3. Refer to Mechanical Drawings legend sheet for general mechanical related abbreviations.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. This section describes specific requirements, products and methods of execution for the single duct, variable air volume, direct digital control terminal units.
 - 2. The method of distribution of air is specified elsewhere.
- B. Performance Requirements:
 - 1. Provide product performance characteristics as specified or scheduled on drawings.

2. Operate ventilation system in accordance with Section 259000 - Sequence of Operations.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS

- A. See section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.
- B. Product Data.
- C. Shop drawings:
 1. This Section shop drawings to be submitted under Section 200000 - Mechanical General Requirements.
 2. Include the following information on the scaled ventilation system shop drawings:
 - a. Air terminal unit locations and sizes, including discharge plenum.
 - b. Equipment tags.
 - c. Control enclosure orientation and access clearance requirements.
 - d. Ductwork connections and sizes.
 - e. Reheat coil and hydronic piping connections and valving as applicable.
 - f. Coil access door locations.
- D. Installation, Operation and Maintenance (IO&M) Manuals.

1.6 CLOSEOUT SUBMITTALS:

- A. See section 200000 - Mechanical General Requirements.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE:

- A. See section 200000 - Mechanical General Requirements.
- B. Certifications: Air terminal units shall be certified under AHRI Standard 880 Certification Program and carry the AHRI seal.

1.9 DELIVERY, STORAGE AND HANDLING

- A. See section 200000 - Mechanical General Requirements for general delivery, storage and handling requirements.

1.10 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements, for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 SINGLE DUCT VARIABLE AIR VOLUME TERMINAL UNITS

- A. Manufacturers:
1. Titus, Model: DESV.
 2. Price.
 3. Nailor Industries.
 4. Substitution request required.
- B. Performance/Design Criteria:
1. Capacities: Provide terminal units of the sizes and performance capacities as scheduled.
 2. Sound Rating:
 3. Sound data certified by AHRI.
 4. Sound ratings for basic air terminal units with inlet diameters less than or equal to 1 inches shall not exceed NC-20 at maximum rated flow (CFM) with a differential static pressure drop of 1.0 inch water column.
 5. Sound ratings for basic air terminal units with inlet diameters larger than 16 inches shall not exceed NC-30 at maximum rated flow (CFM) with a differential static pressure drop of 1.0 inch water column.
 6. Radiated and discharge sound power levels at maximum air flow operating conditions shall be submitted with product information.
 7. Casing Leakage: Less than 2 percent of nominal CFM at 1.5 inches WC differential pressure.
- C. Control Actuator and Application Specific Controller: NEMA 1 control enclosures/digital control packages furnished by Section 255000 - Building Automation System to the air terminal unit manufacturer for factory mounting on side of casing.
- D. Materials:
1. Casing:
 - a. Minimum 22 gauge galvanized steel.
 - b. Mechanically sealed and gasketed, leak resistant construction.
 - c. Beaded inlet for low leakage construction, sized to fit standard round duct.
 - d. Rectangular discharge opening designed for slip and drive cleat connection to low pressure ductwork or reheat coil.
 - e. Multi-port, center averaging inlet velocity sensor with sensor tubing. Flow measurement taps provided for connection to application specific controller.
 - f. Internally line casing with sound liner specified below.
 2. Control Damper:
 - a. Heavy gauge galvanized steel, butterfly type damper.
 - b. One-piece, 1/2-inch diameter damper shaft with self-lubricating Delrin® or bronze oilite bearings or self-lubricating. Notched shaft end, to indicate damper position.
 - c. Synthetic damper seal to limit close-off leakage to less than 1% of terminal rated airflow at 3.0 inches water column differential pressure.Mechanical stop to prevent damper over-stroking.
 3. Duct Transitions:
 - a. Provide rectangular reheat coil discharge plenum:
 - 1). Minimum width to match reheat coil width.
 - 2). Minimum height to match reheat coil height or maximum downstream branch duct spin-in connection diameter plus 4 inches, whichever is greater.

- 3). Minimum length 36 inches or longer to accommodate branch ducts, or as indicated on drawings.
 - b. Sound line duct transitions and plenums to match terminal unit casing liner.
- E. Accessories:
1. Sound Liner:
 - a. UL Listed and in conformance with NFPA Standard 90A. Liners shall be fungi and bacterial resistant.
 - b. Liners shall be fiberglass with foil facing such that no fibers are exposed to airstream, as follows:
 - 1). 1" thick aluminum foil faced fiberglass insulation, 4 pound per cubic foot density, cut edges sealed from airstream using mechanically bonded metal barrier strips.
 - 2). Cut liner edges and seal to prevent erosion with discharge edges secured with metal barrier strips for fiberglass or similar insulation.
 2. Hydronic Reheat Coils:
 - a. Performance characteristics as scheduled.
 - b. Constructed from seamless copper tubing (minimum 0.016-inch wall thickness) with aluminum fins, enclosed in 20 gauge (minimum) galvanized steel casing with slip and drive connections. Provide extended copper sweat connections.
 3. Access Doors: Provide access doors upstream and downstream of reheat coils for coil cleaning. Refer to Section 233100 - Ducts and Accessories.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Installer: Perform work by experienced personnel previously engaged in ventilation system construction and under the supervision of a qualified installation supervisor.

3.2 PREPARATION

- A. Protection of In-Place Conditions: Cover air terminal unit inlet and discharge openings to protect components from construction dirt and debris.

3.3 INSTALLATION

- A. General:
 1. Install air terminal units in strict compliance with the manufacturer's written installation instructions.
 2. Do not locate any part or the terminal unit assembly, including reheat coil and associated low pressure sound lined plenums, such that it passes over a partition wall or through a full height wall penetration.
 3. Locate terminal units such that the bottom of the complete assembly is 6 to 18 inches above the top of the ceiling grid or hard lid ceiling framing as applicable.
 4. Locate terminal unit controller, coil hydronic piping/valves, and coil access doors on same side of unit. Locate on side that maximizes accessibility (i.e. above accessible ceiling tiles, away from full height walls and main duct runs).
 5. Support air terminal units independent of duct system. Provide sway bracing within 12 inches of support attachment.

6. Connect air terminal unit inlets to ductwork using straight sections of unrestricted rigid duct of the same inlet diameter as terminal unit inlet. Provide a minimum straight duct length of 4 duct diameters at each terminal unit inlet. Medium pressure flexible duct connections to terminal units is not allowed except where specifically shown.
7. Close-coupling of a terminal inlet to the side of a main supply duct is not acceptable without written permission from the Contracting Agency. When this method is approved, provide an inlet flow straightening device.
8. Install low pressure ductwork branches vertically centered along the sides of the low pressure sounded lined plenum. A minimum of two (2) inches of sheet metal is required between the spin-in (or similar connection) and top and bottom external edge of the metal plenum.
9. Provide insulated access doors upstream and downstream of reheat coil for coil cleaning.
10. Secure control enclosure cover in place as intended by the manufacturer.
11. Verify mechanical connections, electrical and control wiring and sensor tubing are properly secured.

B. Interface with Other Work:

1. Coordinate and sequence the installation of air terminal units with trades responsible for portions of this and other related sections of the Project Manual.
2. Coordinate ceiling and/or wall access panel locations to provide convenient maintenance and cleaning access for each air terminal unit.
3. Coordinate air terminal unit locations with ceiling grids, lighting troffers, air outlets and return grilles to maximize accessibility and minimize interference.
4. Rework required as a result of failure to follow the manufacturer's written installation instructions, properly coordinate the installation with related work, or provide adequate access (as determined by the Contracting Agency) shall be completed at no additional cost to the Owner.

3.4 REPAIR/RESTORATION

- A. Refer to Section 200000 - Mechanical General Requirements for general repair/restoration requirements.

3.5 SYSTEM START-UP

- A. With the applicable central ventilation system air balancing completed and the ventilation system operating under automatic control utilizing the BAS, cycle each air terminal unit control damper between minimum and maximum scheduled air flow settings to demonstrate proper operation and capacity in accordance with 259000 - Sequence of Operations for verification by the Contracting Agency.
- B. Verify reheat coil and auxiliary heating unit (as applicable) hydronic control valves properly cycle with terminal unit control damper, in accordance with Section 259000 - Sequence of Operations.

3.6 ADJUSTING

- A. Adjust velocity sensor bias adjustment as necessary to provide accurate air flow measurement.
- B. For units with reheat coil supply temperature sensors, verify maximum supply temperature is limited to 20 degrees F above zone temperature setpoint.

3.7 CLEANING

- A. Upon completion of installation and prior to initial operation, vacuum clean and wipe down air terminal units and control enclosures.
- B. Remove any debris from control enclosure.
- C. Inspect and clean reheat coils. Re-straighten coil fins if necessary.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air Diffusers and Registers.
 - 2. Return/Exhaust Grilles.

- B. Related Sections:
 - 1. 200000 - Mechanical General Requirements
 - 2. 200529 - Mechanical Hangers and Supports
 - 3. 230593 - Testing, Adjusting and Balancing
 - 4. 233100 - Ducts and Accessories

1.2 REFERENCES

- A. Codes and Standards:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. SMACNA HVAC Duct Construction Standards - Metal and Flexible Third Edition 2005.
 - 3. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
 - 4. ARI Standard 890-2001 - Air Diffusers and Air Diffuser Assemblies.
 - 5. MOA Handout A.04 - Suspended Ceilings Industry Standard Construction, May 1, 2008.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide product performance characteristics as specified or scheduled on drawings.

1.4 PRE-INSTALLATION MEETINGS

- A. See section 200000 - Mechanical General Requirements.

1.5 SUBMITTALS:

- A. See section 200000 - Mechanical General Requirements for general submittal requirements for the items listed below, supplemented with the additional requirements listed.

- B. Product Data:
 - 1. Air outlets and inlets performance data at operating conditions.

- C. Shop Drawings:
 - 1. This Section shop drawings to be submitted under Section 200000 - Mechanical General Requirements.
 - 2. Include the following information on scaled ventilation system shop drawings:
 - a. Air diffuser, register and grille locations, duct connection sizes and throw directions.

- D. Installation, Operation and Maintenance (IO&M) Manuals.

Southcentral Foundation SLT ICT Renovation

1.6 CLOSEOUT SUBMITTALS:

- A. See section 200000 - Mechanical General Requirements.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE:

- A. See section 200000 - Mechanical General Requirements.

1.9 DELIVERY, STORAGE AND HANDLING

- A. See section 200000 - Mechanical General Requirements.

1.10 WARRANTY

- A. Manufacturer Warranty: See section 200000 - Mechanical General Requirements, for general mechanical warranty requirements.

PART 2 - PRODUCTS

2.1 AIR DIFFUSERS AND REGISTERS

- A. Manufacturers:
 - 1. Titus (Basis of Design).
 - 2. Price.
 - 3. Nailor Industries Inc.
 - 4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Performance/Design Criteria: As scheduled.
- C. Finishes: Unless noted otherwise, standard white baked enamel or powder coated finish suitable for field application of custom finish color as required.
- D. Accessories:
 - 1. Equalizing grids.
 - 2. Earthquake tabs.
- E. Correlate diffuser style, dimension, and fit with ceiling. Provide diffusers with modules of the proper size to match the suspended ceiling layout or with appropriate factory provided frame for surface mounting.

2.2 RETURN/EXHAUST GRILLES

- A. Manufacturers:
 - 1. Titus (Basis of Design).
 - 2. Price.
 - 3. Nailor Industries Inc.

4. Any other manufacturer meeting the requirements of the Contract Documents. Substitution request not required.
- B. Performance/Design Criteria: As scheduled.
- C. Finishes: Unless noted otherwise, standard white baked enamel or powder coated finish suitable for field application of custom finish color as required.
- D. Accessories: Earthquake tabs.
- E. Correlate grille style, dimension, and fit with ceiling. Provide grilles with modules of the proper size to match the suspended ceiling layout or with appropriate factory provided frame for surface mounting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Removal: Remove existing air diffusers, registers and grilles designated for relocation and reuse after repair and cleaning.

3.2 INSTALLATION

- A. General:
 1. Install products in compliance with the manufacturer's written installation instructions.
 2. Connect air outlets, registers, grilles, and louvers to ventilation duct systems in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Air Diffusers, Registers and Grilles:
 1. Install air diffusers, registers and return/exhaust grilles at the locations shown.
 2. Orient and adjust diffusers to provide the throw directions indicated.
 3. Provide appropriate borders for the ceiling, wall, or floor construction type.

3.3 REPAIR/RESTORATION

- A. Refer to Section 200000 - Mechanical General Requirements for general repair/restoration requirements.
- B. Where air outlets and inlets are indicated for reuse, clean and repair existing air outlets and inlets to function as originally intended prior to reinstallation. Air outlets and inlets which require major repair may be replaced at the Contractor's option.

3.4 CLEANING

- A. Clean exposed surfaces of air outlets and inlets, with water and mild soap or detergent not harmful to finish, in order to remove fingerprints and dirt.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: This section describes requirements, products, and methods of execution relating to the building automation controls system for the project.
- B. Related Sections: Refer to related sections for other technical requirements, products, and methods of execution relating to the controls system for monitoring and control of mechanical systems.
 - 1. 200000 - Mechanical General Requirements
 - 2. 230593 - Testing, Adjusting and Balancing
 - 3. 232113 – Hydronic Piping and Specialties
 - 4. 233100 – Ducts and Accessories
 - 5. 233600 - Air Terminal Units
 - 6. 259000 - Sequence of Operations
 - 7. Divisions 26, 27 and 28 - Electrical

1.2 REFERENCES

- A. Codes and Standards. Perform work in accordance with applicable national, state and local codes to include:
 - 1. See section 200000 - Mechanical General Requirements.
 - 2. ANSI-C2, National Electrical Safety Code - NESC.
 - 3. Underwriters Laboratory (UL) or approved equal.
 - 4. Institute of Electrical and Electronics Engineers - IEEE.
 - 5. National Electrical Manufacturers' Association - NEMA.
- B. Abbreviations and Acronyms:
 - 1. Building Automation System (BAS).
 - 2. Direct Digital Control (DDC).
- C. Definitions:
 - 1. ASHRAE: The American Society of Heating, Refrigerating and Air-Conditioning Engineers.
 - 2. BACnet: A Data Communication Protocol for Building Automation and Control Networks, ANSI/ASHRAE Standard 135-current edition, developed under the auspices of ASHRAE.
 - 3. Bridge: A device that routes messages or isolates message traffic to a particular segment, sub-net or domain of the same physical communication media.
 - 4. Building Automation System (BAS): Collection of sensors, operators, controllers, and interconnecting wiring that control the operation of the building mechanical and electrical systems as described in these specifications.
 - 5. Field device or field control device: A physical component such as a temperature sensor, pressure sensor, contact, motor operated valve, and motor operated damper. Generally considered to bring only one point to a controller.
 - 6. Gateway: A hardware/software package that allows communication between dissimilar (“foreign”) systems and different protocols. Gateways are typically custom built,

- configured, and used only for transmitting and receiving data between different systems. System programming through gateways is not possible within the scope of this definition.
7. LonTalk: An open protocol for communication developed privately by the Echelon Corporation in Palo Alto, California.
 8. Operator workstation: The central personal computer for the user to implement day to day operation of the system.
 9. Router: A device for connecting different local-area network segments within a network. Routers that are used between networks with different protocols are limited. Point mapping in this type of router is automatic and requires less than one hour to configure. This device is not capable of storing point map information.
 10. TCP/IP (Transmission Control Protocol/Internet Protocol): The communication language or protocol that defines the Internet. TCP/IP can also be used as a communication protocol in private networks.
 11. Terminal Unit Controller: A device to control very specific applications such as a VAV box, cabinet unit heater, fan terminal unit and the like. These units may have predefined operating sequences with limited custom programming available. (Also called an “application specific controller”).

1.3 SYSTEM DESCRIPTION

A. Design Requirements:

1. The HVAC Control System will consist of a flat, open architecture based upon BACNet meeting the requirement of ANSI/EIA 709.1 and ASHRAE Standard 135. Provide necessary BACnet-compliant hardware and software to meet the system’s functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
2. The system shall operate as a low-voltage multiplexed data system. The controls and instrumentation specified herein shall be integrated and installed as a complete package by the Contractor.
3. The completed system shall be integrated such that graphics, reports, and system interfaces from the Operators workstation appears as if there is one system.
4. No BAS system components requiring the use of gateways will be accepted.
5. To provide future flexibility, router domains shall not exceed nominally 75 percent of the maximum number of devices in the domain, unless specified otherwise.

B. Performance Requirements:

1. This section specifies the requirements for the BAS to be installed in conjunction with this project.
2. Controls contractor shall furnish and install an integrated building automation system, incorporating DDC for energy management, equipment monitoring and control, and subsystems as herein specified. Controls contractor will complete the temperature control system as specified herein.
3. Materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project. Systems and components shall have been thoroughly tested and proven in actual use for at least two years.
4. Controls contractor shall be responsible for BAS and temperature control wiring for a complete and operable system. Wiring shall be done in accordance with Divisions 26, 27 and 28 of this specification and local and national codes.

5. Control and monitoring for mechanical systems installed under this Contract, including:
 - a. Building ventilation systems.
 - b. Building heating systems.
 - c. Domestic water heater trouble/alarm monitoring.
 - d. Dental air and vacuum system trouble/alarm monitoring.
6. The Work under this Section includes furnishing and installing wiring, conduit, connectors, terminal strips, and any other equipment required to interface each sensor or control point to the control system.
7. Provide control system and subsystem network cabling, routers, and other devices required for the systems shown and specified, except as specifically noted or shown on the drawings.
8. Providing sequences of operation described in Section 259000 - Sequence of Operations.
9. Installation of control instrumentation and hardware specified in Section 253000 - Building Automation System Field Devices, necessary for a complete system of controls.
10. Integrating the controls under this Contract with the Owner's HVAC Supervisory System.
11. Commissioning support activities as required in 019100 - Commissioning, including requirements in development of commissioning checklists, phased commissioning, installation examination and performance test activities, training and IO&M requirements. BAS contractor shall provide field and office support of commissioning activities.
12. System functional requirements include, but are not limited to:
 - a. BAS system shall provide all normal and off-normal control functionality without reliance upon PC file server or workstation.
 - b. Programming information, graphics, databases, and other information required to restore the entire system in the event of equipment failure or malfunction or human error shall be protected with a centralized back-up system.
 - c. Systems shall be designed to maximize multiple-vendor flexibility to replace or modify any portion of the system.
13. Software upgrades for PC and control network operating systems, the supervisory system, web browser, programming/binding tools, etc., without limitation shall be provided at no additional charge for a period of one year after Substantial Completion of the BAS.
14. A training program shall be provided to include: Data acquisition and report generation on the Operator's workstation.
15. The cost of providing power from the building electrical system shall be included in the bid. Power sources are subject to submittal requirements, and review and approval.

1.4 PREINSTALLATION MEETINGS

- A. Coordinate installation of the building automation system with trades responsible for portions of this and any other related sections of the Project Manual prior to installation of any components.

1.5 SUBMITTALS

- A. Refer to Section 200000 - Mechanical General Requirements for general submittal requirements.
- B. Product Data:
 1. Provide manufacturer's literature that demonstrates compliance with the manufacturing methods, appurtenances and salient features specified.
 2. Equipment tagging method specifically listing each device and the identification tag to be applied.
 3. Sequence of Operations.
 4. Riser Diagrams.
 5. Control Diagrams.

6. Panel layouts.
7. Valve and Damper schedules.
8. Point Summary Report.
9. Blank (Reserved for Enhanced Alarm Report).
10. Blank (Reserved for Commented PPCL).
11. Blank (Reserved for Trend Logs).
12. Blank (Reserve for Electronic Plans Room file).

C. Shop Drawings:

1. Riser Diagrams.
2. Control Diagrams.
3. Panel layouts.
4. Valve and Damper schedules.

D. Quality Control Submittals:

1. Pre-functional Installation (PC) and Functional Performance Test (FT) Checklists in accordance with Section 019100 - Commissioning.
2. Incorporate BAS control requirements into the applicable equipment PC/FT checklists.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:

B. Operation and Maintenance Data. The O&M Manuals will consist of the following (Progression from Submittal to O&M Manual takes place using the same binders):

1. Sequence of Operations.
2. Riser Diagrams.
3. Control Diagrams.
4. Panel layouts.
5. Valve and Damper schedules.
6. Point Summary Report.
7. Enhanced Alarm Report.
8. Commented PPCL (Program Code).
9. Trend Logs.
10. Product Data including items reused from existing control system as noted.
11. Electronic Plans Room file.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: Companies specializing in manufacturing the products specified in this section with a minimum of three (3) years documented experience.
2. Suppliers:
3. Fabricators:
4. Installers: Minimum three (3) years' experience in the installation, programming and start-up of building automaton systems.
5. Testing Agencies: Regulatory requirements for products requiring electrical connection – Listed and classified by Underwriters Laboratories Incorporated, or by a testing firm acceptable to the MOA.
6. Licensed Professionals:

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Verify equipment and associated appurtenances are delivered in original factory packaging/crating and are free from damage and corrosion.
2. Replace equipment delivered to job site that does not comply with above requirements at no expense to the Owner.

B. Storage and Handling Requirements:

1. Store products in covered storage area, protected from the elements, outside the general construction area until installed.
2. Handle items carefully to avoid breaking, chipping, denting, scratching, or other damage.
3. Replace damaged items with same item in new condition.

1.9 WARRANTY

A. Manufacturer Warranty:

1. Provide in accordance with Section 200000 - General Mechanical Requirements.
2. Provide maximum 4 hour response time to service/warranty calls from the Owner during the warranty period.

B. Special Warranty:

1. The warranty shall consist of a commitment by controls contractor to provide, at no cost to the Owner, parts and labor as required to repair or replace such parts of the control system that prove inoperative due to defective materials or installation practices.
2. The warranty expressly excludes routine service such as instrument calibration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Existing facility Building Automation System is Alerton Technologies by ATS Alaska.

1. Building Automation System for this project shall match existing.

B. Management Level Network (MLN). Acceptable manufacturers are limited to the following:

1. Alerton Technologies.
2. No Alternate Brand Request; no Substitution Request.

C. Building Level Network (BLN). Acceptable manufacturers are limited to the following:

1. Alerton Technologies.
2. No Alternate Brand Request; no Substitution Request.

D. Floor Level Network (FLN). Acceptable manufacturers are limited to the following:

1. Alerton Technologies.
2. No Alternate Brand Request; no Substitution Request.

2.2 APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:

1. Application Specific Controllers shall be equipped with a minimum of 64K programmable non-volatile (flash) memory for general data processing, power supply, input/output modules, termination blocks, network transceivers.
2. Operating system software, custom operating sequence software and application programs shall be stored in programmable, non-volatile memory.
3. The ASC unit may be equipped with a dedicated software clock battery. If included, the battery shall be capable of maintaining time of day, day of week, date, month, and year, independent of system power for a two-week period. Include an integral calendar with automatic leap year compensation.
4. ASC packaging shall be such that complete installation and checkout of field wiring can be performed prior to the installation of electronic boards. Make board terminations by means of plug-in connectors to facilitate troubleshooting, repair and replacement.

B. ASC Interface Software:

1. General: ASC shall be configured, not programmed, via PC based interface software. This software shall be a program applet that runs within the network management tool chosen. Intimate knowledge of operation of ASC shall not be required for configuration.
2. ASC shall provide a selection of control applications performable through configuration of the device. Download of new application should not be required for one of these applications.

C. ASC Device Software:

1. General: An ASC shall operate in standalone mode as needed for specified control applications if network communication fails. Software shall include a complete operating system (O.S.), communications handler, point processing, standard control algorithms, and specific control sequences.
2. Operating system software shall reside in programmable flash memory, operate in real-time, provide prioritized task scheduling, control time programs, monitor and manage network communications, and scan inputs and outputs. The operating system shall also contain built in diagnostics.

2.3 APPLICATION GENERIC CONTROLLER (AGC)

A. General Requirements:

1. Application Generic Controllers shall be equipped with a minimum of 64K programmable non-volatile (flash) memory for general data processing, power supply, input/output modules, termination blocks, network transceivers.
2. Operating system software, custom operating sequence software and application programs shall be stored in programmable, non-volatile memory.
3. The AGC unit may be equipped with a dedicated software clock battery. If included, the battery shall be capable of maintaining time of day, day of week, date, month, and year, independent of system power for a two-week period. Include an integral calendar with automatic leap year compensation.
4. AGC packaging shall be such that complete installation and checkout of field wiring can be performed prior to the installation of electronic boards. Make board terminations by means of plug-in connectors to facilitate troubleshooting, repair and replacement. Network and power wiring shall allow for 'pass-thru' of signal when electronic boards are removed.

B. AGC Interface Software:

1. General: AGC shall be configured, not programmed, via PC based interface software. This software shall be a program applet that runs within the network management tool chosen. Intimate knowledge of operation of AGC shall not be required for configuration.
2. AGC shall provide a selection of control applications performable through configuration of the device. Download of new applications from network management tool shall be possible, but not required.

2.4 CUSTOM APPLICATION CONTROLLER (CAC)

A. General Requirements:

1. Custom Application Controllers shall be equipped with a minimum of 64K programmable non-volatile (flash) memory for general data processing, power supply, input/output modules, termination blocks, network transceivers.
2. Operating system software, custom operating sequence software and application programs shall be stored in programmable, non-volatile memory.
3. CAC unit may be equipped with a dedicated software clock battery. If included, the battery shall be capable of maintaining time of day, day of week, date, month, and year, independent of system power for a two-week period. Include an integral calendar with automatic leap year compensation.
4. CAC packaging shall be such that complete installation and checkout of field wiring can be performed prior to the installation of electronic boards. Make board terminations by means of plug-in connectors to facilitate troubleshooting, repair and replacement. The complete CAC including accessory devices such as relay, transducers, power supplies, etc. shall be factory-mounted, wired and housed in a NEMA 1 enclosure or as required by the location and local code requirements.
5. Equip CAC's with diagnostic indicators for the following:
 - a. Transmit.
 - b. Receive.
 - c. Power up test.
 - d. Power up fail.
 - e. Power up test okay.
 - f. Bus error.

B. CAC Software:

1. General: A CAC shall operate in standalone mode as needed for specified control applications if network communication fails. Software shall include a complete operating system (O.S.), communications handler, point processing, standard control algorithms, and specific control sequences.
2. Operating system software shall reside in programmable flash memory, operate in real-time, provide prioritized task scheduling, control time programs, monitor and manage CAC to OI communications, and scan inputs and outputs. The operating system shall also contain built in diagnostics.
3. Input/Output Point Processing Software shall include:
 - a. Continuous update of input and output values and conditions. Connected points are to be updated at a minimum of one-second intervals.
 - b. Analog to digital conversion, scaling and offset, correction of sensor non-linearity, sensing no response or failed sensors, and conversion of values to 32 bit floating point format. Both the maximum and minimum values sensed for each analog input are to be retained in memory. It shall be possible to input subsets of standard sensor

- ranges to the A/D converter and assign gains to match the full-scale 32-bit conversion to achieve high accuracy readout.
- c. A reasonability check on analog inputs against the previously read value and discard those values falling outside pre-programmed reasonability limits.
 - d. Assignment of proper engineering units and status condition identifiers to analog and digital input and outputs.
 - e. Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and actual alarm) to an input or to assign a set of floating limits (alarm follows a reset schedule or control point) to the input. Each alarm shall be assigned a unique differential to prevent a point from oscillating into and out of alarm. Alarm comparisons shall be made each scan cycle.
 - f. Debounce of digital inputs to prevent nuisance alarms. Debounce timing shall be adjustable from two seconds to two minutes in one second increments.
4. Alarm lockouts:
 - a. Alarm lockout software shall be provided to prevent nuisance alarms. on initial start-up of air handler and other mechanical equipment a "timed lockout" period shall be assigned to analog points to allow them to reach a stable condition before activating alarm comparison logic. Lockout period is to be programmable on a per point basis from 0 to 90 minutes in one minute increments.
 - b. A "hard lockout" shall also be provided to positively lock out alarms when equipment is turned off or when true alarm is dependent on the condition of an associated point. Hard lockout points and lockout initiators are to be operator programmable.
 - c. Design the power supply to accommodate the power requirements of all components (or nodes) connected, plus 50 percent.
 5. Run Time Totalization or Point Trending:
 - a. Run time shall be accumulated based on the status of a digital input point. It shall be possible to totalize either on time or off time up to 10,000 hours with one-minute resolution. Run time counts shall be resident in non-volatile memory and have CAC resident run time limits assignable through the operator's terminal.
 - b. Totalized run time or trended data shall be batch downloaded using FTP to the SS on a daily or weekly basis. Trended data shall reside on the SS database server. The automatic update of this data shall be determined by the SS and facility management application requirements.
 6. Transition Counting:
 - a. A transition counter shall be provided to accumulate the number of times a device has been cycled on or off.
 - b. Counter is to be non-volatile and be capable of accumulating 600,000 switching cycles.
 - c. Limits shall be assignable to counts to provide maintenance alarm printouts.
 7. Custom Direct Digital Control (DDC) Loops:
 - a. Custom DDC programs are to be provided to meet the control strategies as called for in the sequence of operation sections of these specifications.
 - b. Each CAC shall have residential in its memory and available to the programs a full library of DDC algorithms, intrinsic control operators, arithmetic, logic and relational operators for implementation of control sequences:
 - 1). Proportional Control, Proportional plus Integral (PI), Proportional plus Integral plus Derivative (PID), and Adaptive Control (self-learning): The adaptive control algorithm shall be used on control loops, as indicated in I/O summary, where the controlled medium flow rate is variable (such as VAV units and variable flow pumping loops). The adaptive control algorithm

shall monitor the loop response characteristics in accordance with the time constant changes imposed by variable flow rates. The algorithm shall operate in a continuous self-learning manner and shall retain in memory a stored record of the system dynamics so that on system shutdown and restart, the learning process starts from where it left off and not from ground zero. Standard PID algorithms are not acceptable substitutes for variable flow applications since they will provide satisfactory control at only one flow rate and will require continued manual fine tuning.

- 2). DDC setpoints, gains and time constants associated with DDC programs shall be available to the operator for display and modification via the SS operator interface.
- 3). The execution interval of each DDC loop shall be adjustable from 2 to 120 seconds in one-second increments.
- 4). DDC control programs shall include an assignment of initialization values to outputs to assure that controlled devices assume a fail-safe position on initial system start-up.

2.5 VAV CONTROLLERS

- A. Provide manufacturer's thermostat matched to controller. Refer to Section 253000 - Building Automation System Field Devices, for requirements.
- B. Coordinate with Section 233600 - Air Terminal Units to have VAV controllers factory mounted on the VAV terminal unit.
- C. For applications requiring consistent airflow for space pressure control, provide VAV controllers with an auto-zero module to allow for periodic airflow sensor calibration without interruption of airflow.

2.6 ROUTERS, BRIDGES, REPEATERS AND TRANSCEIVERS

- A. Routers, Bridges and Repeaters:
 1. Equip each router and bridge with a network transceiver on each network port (inbound and outbound) as dictated by the network type (Type 1 - FTT, Type 2 - TP, Type 3 - PL, Type 4 - LP, Type 5 - RF).
 2. The network router shall be designed to route messages from a segment, sub-net, or domain in full duplex communication mode.
 3. Routers with TCP/IP capability shall be provided where TCP/IP backbone is used.
 4. Routers, bridges and repeaters shall be fully programmable and permit a systems integrator to define message traffic, destination, and other network management functions.
 5. The routers, bridges, and repeaters shall be capable of DIN rail or panel mounting and be equipped with status LED lights for Network traffic and power.
- B. Transceivers:
 1. Type 1 Network Transceiver, Free Topology, Twisted Pair: Provide a transformer isolated, twisted pair transceiver capable of mounting directly on a printed circuit board. The transceiver shall meet the following specifications:
 - a. Differential Manchester encoded signaling for polarity insensitive network wiring.
 - b. Transformer isolated for common mode rejection.
 - c. 78 Kbps network bit rate up to distances of 2000m.
 - d. Free topology supports star, home run, multi drop and loop wiring topologies.

- e. Complies with FCC and VDE requirements.
 - f. UL recognized component.
2. Type 2 Network Transceiver, Twisted Pair: Provide a transformer isolated twisted pair transceiver capable of mounting directly on a printed circuit board. The transceiver shall meet the following specifications:
 - a. Differential Manchester encoded signaling for polarity insensitive network wiring.
 - b. Transformer isolation for common mode rejection.
 - c. 1.25 Mbps network bit rate up to distances of 1000 meters.
 - d. Unpotted construction.
 - e. Less than 1 mA power consumption with +5VDC input voltage.
 - f. FCC and VDE Level B requirements compliance.
 - g. UL Listed.
3. Type 3 Network Transceiver, Power Line:
 - a. Provide a direct sequence, spread spectrum power line transceiver which is equipped with the following signal processing and error correction capabilities to provide robust and error free communications.
 - 1). Forward Error Correction (FEC) to enable the system to read and reconstruct corrupted packets without sacrificing throughput. The FEC shall require only six percent overhead for error correction.
 - 2). Automatic sensitivity adjustment algorithm that dynamically changes the receiver sensitivity based on noise characteristics.
 - 3). Oversampling correlation filter and adaptive data recovery algorithm to synchronize instantaneously to incoming packets.
 - 4). Tri-state power amplifier/filter combination to provide a powerful output signal with a minimum number of components.
 - b. The transceiver shall be able to operate using the controller power supply and coupling circuit. Provide the following general features as a minimum:
 - 1). Packaged in a rugged, potted module.
 - 2). Programmable clock output (1.25, 2.5, 5 or 10 Mhz).
 - 3). 10 Kbps network transmission rate.
 - 4). Packet detect output to drive a status indicator LED.
 - 5). Minus 20 to plus 85 degrees C. operating temperature range.
 - 6). UL Listed.
4. Type 4 Network Transceiver, Link Power: Provide a twisted pair transceiver that utilizes the twisted pair communication media to provide power for Controller(s). The transceiver shall meet the following specifications:
 - a. Free single-in-line package (SIP) construction.
 - b. Send both network data and power on a twisted wire pair.
 - c. Differential Manchester encoded signaling for polarity insensitive network wiring.
 - d. 78 Kbps network bit rate up to distances of 320 meters.
 - e. Supports star, home run, multidrop, and loop wiring.
 - f. Supplies +5VDC @ 100 mA maximum for node power.
 - g. Compliance with FCC and VDE requirements.
 - h. UL Listed.
5. Type 5 Network Transceiver, Radio Frequency: Provide a direct sequence, spread spectrum RF transceiver that meets the following specifications:
 - a. 100 meter open field range.
 - b. Wireless communications extends network between buildings and to vehicles and portable devices.
 - c. FCC type certifiable, 48 MHz.
 - d. Low-cost miniature circuit board, SMT components.

- e. Carrier detect output to drive a status indicator LED.
- f. Plus 7 to plus 15VDC input voltage.
- g. Minus 20 to plus 60 degrees C. operating temperature range.

2.7 OPERATOR WORKSTATION

- 1. Use existing.

2.8 PERSONAL COMPUTER OPERATOR WORKSTATION HARDWARE

- A. Use existing.

2.9 WORKSTATION OPERATOR INTERFACE

A. Basic Interface Description:

- 1. Operator workstation interface software shall minimize operator training through the use of English language prompting, 30-character English language point identification, on-line help, and industry standard PC application software. Interface software shall simultaneously communicate with up to 4 Building Level Networks and share data between any of the 4 networks. The software shall provide, as a minimum, the following functionality:
 - a. Real-time graphical viewing and control of environment.
 - b. Scheduling and override of building operations.
 - c. Collection and analysis of historical data.
 - d. Point database editing, storage and downloading of controller databases.
 - e. Alarm reporting, routing, messaging, and acknowledgment.
 - f. Display dynamic data trend plot.
 - g. Definition and construction of dynamic color graphic displays.
 - h. Program editing.
 - i. Transfer trend data to third party software.
 - j. Scheduling reports.
 - k. Operator Activity Log.
- 2. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device and "point and click" approach to menu selection.
- 3. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information.
- 4. Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported).
- 5. Scheduling and Override: Provide a calendar type format for simplification of time-of-day scheduling and overrides of building operations. Schedules reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection or function key.
- 6. Collection and Analysis of Historical Data: Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data may be stored on hard disk for

future diagnostics and reporting. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

B. Dynamic Color Graphic Displays:

1. Create at least one color graphic display for each piece of mechanical equipment, including air handling units, hot water boiler systems, and room level terminal units. Provide floor plans to facilitate navigation. Point information to be displayed on the graphics shall be provided by the BAS contractor to optimize system performance and analysis and to speed alarm recognition.
2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands. Graphics software shall permit the importing of submittal AutoCAD drawings and scanned pictures for use in the system.
3. Dynamic temperature values, flow values and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
4. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
5. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
6. A dynamic display of the site-specific architecture showing status of controllers, PC workstations and networks shall be provided.

C. System Configuration and Definition:

1. Network wide control strategies shall not be restricted to a single DDC Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
2. Provide automatic backup and restore of DDC controller databases on the workstation hard disk. In addition, database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller. Changes made at the DDC Controllers shall be automatically uploaded to the workstation, ensuring system continuity.

D. Alarm Management:

1. Alarm Routing shall allow the user to send alarm notification to selected PC locations based on time of day, alarm severity, or point type.
2. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message. The alarm display shall provide a mechanism for the operator to sort alarms.
3. Alarm messages shall be customizable for each point to display detailed instructions to the user regarding actions to take in the event of an alarm.

E. 3 (BLN) and DDC Controller floor level local area networks (FLN). Access to the system shall be totally transparent to the user when accessing data or developing control programs.

F. Management Level Network:

1. PCs shall simultaneously direct connect to the Ethernet and Management Level Network without the use of an interposing device.

2. The Management Level Network shall not impose a maximum constraint on the number of operator workstations.
3. Simultaneous user access to network limited to number of sight licenses issued to user.
4. When appropriate, any DDC controller residing on the peer-to-peer building level network shall connect to Ethernet network without the use of a PC.
5. Any PC on the Ethernet Management Level Network shall have transparent communication with controllers on the building level networks connected via Ethernet as well as directly connected building level networks. Any PC shall be able to interrogate any controller on the building level network in addition to being able to download program changes to individual controllers.
6. The Management Level Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3.
7. Access to the system database shall be available from any client workstation on the Management Level Network.

G. Peer-to-Peer Building Level Network (BLN):

1. The system shall have the ability to support integration of third party systems (fire alarm, security, lighting, variable speed drives, PLCs, condensers, boilers) via a panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. Exchange points shall have full system functionality as specified herein.
2. Data transfer via Ethernet.

H. Floor Level Network (FLN):

1. This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data.

2.10 CONTROL PANELS

- A. Terminal Equipment Controllers will be mounted in enclosed control panels with screwed, removable covers.
- B. Control devices located in exposed areas subject to outside weather conditions or near circulator pumps (spray due to shaft seal failures) shall be mounted inside weatherproof enclosures. Location of each panel shall be convenient for adjustment service.
- C. Nameplates shall be provided beneath each panel face mounted control device describing the function of each device. Nameplates shall have white letters engraved on blue Lamicoid, or approved equal.
- D. Control panels shall bear a UL label compatible with the application.
- E. Electrical devices within the panel shall be pre-wired to terminal strips, with inter-device wiring within the panel completed prior to installation of the system.
- F. BLN level controllers shall be provided with standby/emergency power to provide power quality and minimum 15 minutes operation.

2.11 UNINTERRUPTIBLE POWER SUPPLY

- A. Acceptable manufactures are limited to the following:
 - 1. Powerware.
 - 2. Alternate Brand Request or Substitution Request required.

2.12 ACCESS PANELS

- A. Access panels provided by Section 083113.
- B. Coordinate access panel location with the Owner's Representative and Section 083113. Provide access to concealed control devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Special Techniques:
 - 1. Mount damper operators and other control devices secured to insulated ductwork on brackets such that the device is external of the insulation. See Section 200529 - Hangers and Supports.
 - 2. Do not install control devices in locations where they are subject to damage or malfunction due to normally encountered ambient temperatures.
 - 3. Identification: Permanently tag controllers, switches, relays, thermostats and actuators for identification using the tagging format shown on the BAS control drawings.
 - 4. Sensors and Switches:
 - a. Pump flow or fan flow, etc., shall be sensed using current switch unless indicated otherwise. Calibrate current switch to distinguish between loaded or unloaded motor condition due to belt or coupler breakage.
 - b. Protect averaging or capillary tubes where they penetrate duct with rubber grommet and seal with clear silicon. Support with capillary clips and maintain minimum 1 inch tubing bending radius.
 - 5. Wiring:
 - a. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories. Install wiring in exposed or inaccessible areas in EMT conduit. Plenum-rated cable may be used in concealed, accessible areas only.
 - b. Provide wiring between thermostats and unit heater motors, and control and alarm wiring.
 - c. Provide conduit and wiring between the BAS panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring in conduit or plenum-rated cable.
 - d. Provide conduit and control wiring for devices specified in this Section.
 - e. Provide conduit and signal wiring between motor starters in motor control centers and high and/or low temperature relay contacts and remote relays in BAS panels located in the vicinity of motor control centers.
 - f. Provide conduit and wiring between the PC workstation, electrical panels, metering instrumentation, indicating devices, miscellaneous alarm points, remotely operated contactors, and BAS panels, as shown on the drawings or as specified.

- g. Wiring shall be compliant with the Divisions 26, 27 and 28 requirements and the NEC.
 - h. Provide electrical wall boxes and conduit sleeves for wall-mounted devices. Mount thermostats at 54 inches AFF unless otherwise noted.
 - i. Ethernet drop at or near designated BAS control panel(s), and as needed.
- B. Interface with Other Work:
- 1. The Contractor is responsible to furnish and install complete and operational systems. The following breakdown is recommend; carefully coordinate work between subcontractors.
 - 2. Products furnished by BAS contractor for installation by the mechanical contractor:
 - a. Control valves.
 - b. VAV box controllers.
 - 3. Products furnished and installed by mechanical contractor:
 - a. VAV boxes. BAS contractor shall furnish VAV box controls to the VAV box manufacturer for factory installation at the expense of the box manufacturer.
 - b. VAV box controller enclosures will be provided by box manufacturer.
 - c. Gauges, thermometers and thread-o-lets for BAS contractor furnished control sensor wells.
 - d. Airflow measuring stations.
 - e. Control and balancing dampers.
 - f. Smoke and fire/smoke dampers actuators.
 - 4. Electrical contractor (Div. 26) provides:
 - a. Wiring of power feeds through disconnect starters to electrical motors.
 - b. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by controls contractor.
 - c. Duct smoke detectors including installation and wiring.
 - d. Power wiring of smoke/fire dampers provided by Divisions 20, 21, 22, 23, 25.
 - e. Stand-alone packaged controls and wiring of stand-alone packaged controls to their remote sensors and devices.
- C. System Integration. Products to receive integration under this section:
- 1. Fire Alarm/Life Safety System:
 - a. The BAS shall communicate with the fire alarm/life safety system via an alarmable point in the form of a dry contact.
 - b. The device will be provided and terminated by Divisions 26, 27 and 28. This section will provide wiring to the termination device.

3.2 PROGRAMMING

- A. Programming and graphics shall be included to implement the controls sequences specified in Section 259000 - Sequence of Operations, and to implement the systems and features included in Facility Services Divisions 20-28. It shall not be necessary for the Contracting Agency to further program the system.
- B. Provide licensed copies of software tools and programming aids used to install, develop and troubleshoot the controls system to the Contracting Agency. Assist the Contracting Agency in registering the software in Contracting Agency's name.
- C. Implement the control sequences for the equipment on this project as contained in Section 259000 - Sequence of Operations.

- D. Point identifiers shall be chosen for easy identification of the actual equipment being controlled or monitored. They shall include equipment tag identifiers shown on the drawings, and may include additional characters to identify floor, area, etc. Maintain a listing of identifiers used in this project, with their plain English names. Submit the listing for review and information.

3.3 GRAPHICS

- A. Graphical Mechanical Displays: Create graphical displays of major mechanical equipment for this project and install graphics on the PC-based workstations. At a minimum, these graphical displays shall include building floor plans derived from architectural AutoCAD representations and graphical representations of the equipment controlled under this contract.
1. Plans:
 - a. Provide a central site plan for the entire facility and immediate surroundings. As a minimum indicate the following:
 - 1). Area designation.
 - 2). Number of levels on each area.
 - 3). Adjacent street names.
 - 4). North arrow.
 - b. Provide floor overall floor plans for each level of the facility. As a minimum indicate the following:
 - 1). Area designation and level.
 - 2). Mechanical and electrical rooms.
 - 3). Control panel locations.
 - 4). North arrow.
 - c. Provide individual floor plans for the facility. As a minimum indicate the following:
 - 1). Walls, doors, and general floor plan arrangement.
 - 2). Mechanical and electrical rooms.
 - 3). Temperature sensors.
 - 4). Temperature control zones.
 - 5). Control panel locations.
 - 6). North arrow.
 - 7). List of major HVAC systems serving the area including but not limited to the following:
 - a) Air handling systems.
 - b) Exhaust fans.
 - c) Toilet exhaust fans.
 - d) Heating systems.
 - e) Cooling systems.
 - d. As a minimum provide the following functional links on for each floor plan:
 - 1). Provide links back and forth between the plan screens noted above.
 - 2). On floor plan with temperature sensor, provide dynamic color coding for each sensor as follows:
 - a) Blue indicates space temperatures less than 65 degrees F.
 - b) Green indicates space temperatures between 66 degrees and 74 degrees F.
 - c) Red indicates space temperatures above 75 degrees F.
 - 3). Provide a link to each VAV terminal unit from the associated temperature sensor.
 - 4). Provide a link to each major mechanical system serving the temperature sensor.

2. Room Reheat coils:
 - a. Indicate the following information for each unit:
 - 1). Room Temperature.
 - 2). Coil valve position percent.
 - 3). Fintube valve position percent.
 3. Air Handling: Indicate the following information for each AHUs/MAUs, relief/exhaust fans, and toilet exhaust fans:
 - a. Put control points and adjustable set points on the screen.
 - b. Define action of dampers and valves (N/O or N/C);
 - c. Fan schedule override commands.
 - d. Reset schedules.
 - e. Outside air CFM and minimum requirement.
 - f. Duct static set point.
- B. Use approved designations for room names, spaces, equipment tags, etc.

3.4 SITE QUALITY CONTROL

- A. Document each installation and operational step utilizing the approved PC/FT checklists in accordance with Section 019100 - Commissioning.
- B. Programming BAS to provide system operation and monitoring in accordance with Section 259000 - Sequence of Operation and other referenced sections.
- C. Trend Logs:
 1. Prepare trend logs for all points required to demonstrate BAS calibration, control and stability.
 2. Trend logs shall document building operation after applicable PC/FT checklists are completed and building site commissioning is satisfactorily completed.
 3. Set points, valve positions, etc. may be temporarily adjusted to artificially induce the intended sequences to occur.

3.5 CLOSEOUT ACTIVITIES

- A. Demonstration:
 1. Provide demonstrations in accordance with Section 017900 - Demonstrations and Training.
 2. Demonstrate the proper operation and control of systems controlled and monitored by the BAS.
 3. The demonstration shall include, but not necessarily be limited to, the following:
 - a. Review of the Trend Logs.
 - b. Complete and proper operation of control systems including simulations.
 - c. Access to devices for required maintenance.
 - d. Review of associated graphics on Host.
- B. Training:
 1. Provide training in accordance with Section 017900 - Demonstrations and Training.
 2. In addition, provide forty (8) eight of on-site instruction by BAS contractor to familiarize operating personnel with the control system. Instructions will include:
 - a. A brief description of the controls' sequence of operation.
 - b. A discussion and explanation of alarms, switches and gauges.

- c. A summary and explanation of steps to be taken in response to specific alarms or control malfunctions.
- d. Building walk-through to physically locate and examine control devices and demonstrate control setpoint adjustment procedures.
- e. Instructions regarding adjustment procedures shall emphasize methods for continual building "fine-tuning".

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: This section describes the building automation system (BAS) control sequences for the heating, ventilating and air-conditioning (HVAC) systems, electrical systems and plumbing systems provided for this project.
- B. Related Sections: Refer to Section 255000 - Building Automation System

1.2 REFERENCES

- A. Refer to Section 255000 - Building Automation System.

1.3 SYSTEM DESCRIPTION

- A. Refer to Section 255000 - Building Automation System.

1.4 PREINSTALLATION MEETINGS

- A. Refer to Section 255000 - Building Automation System.

1.5 SUBMITTALS

- A. Submit in accordance with Section 255000 - Building Automation System and in accordance with Division 1.
- B. Product Data:
 - 1. Provide BAS manufacturers' product literature, clearly annotated to indicate performance criteria to include the following:
 - a. Building level to floor level network controller riser diagrams. Include building locations and equipment controlled by each controller.
 - b. Sequences of operation for HVAC, electrical and plumbing systems.
 - c. Process control diagrams to support each sequence of operation. Show field mounted control device locations and circuit routing.
 - d. Complete electrical and pneumatic BAS points list.
- C. Quality Assurance/Control Submittals:
 - 1. Installation and Functional Performance Test Letter.
 - a. Provide a letter certifying that the building automation system hardware is completely installed and sequences of operation have been programmed, operationally tested, with physically verification, to comply with the sequences of operation as specified. The installer(s), sub-contractor(s) and the Contractor must sign the letter.
 - b. Include as an attachment, a list of programming deviations from the specified sequences of operation with justification to support each deviation.
 - c. Include as an attachment, a table of final adjustable setpoint values for each applicable control point.

- D. Installation, Operation and Maintenance Data:
 - 1. Refer to Section 200000 – Mechanical General Requirements, for IO&M Manual formatting requirements and number of copies required.
 - 2. Provide approved submittal information, revised to reflect the actual installation as addressed in the attachments provided with the Installation and Functional Performance Test Letter, for inclusion within the project IO&M Manual.

1.6 CLOSEOUT SUBMITTALS

- A. Submit in accordance with Section 255000 - Building Automation System and in accordance with Division 1.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. See section 200000 - Mechanical General Requirements.

1.8 QUALITY ASSURANCE

- A. Refer to Section 255000 - Building Automation System.
- B. Qualifications of Installers/Programmers: Minimum 3 years' experience in the installation and programming of direct digital control systems.

1.9 WARRANTY

- A. Refer to Section 255000 - Building Automation System.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 ROOM TEMPERATURE CONTROLS

- A. Room Temperature Controls and Monitoring: Provide room temperature monitoring and alarming capabilities via the BAS system to generate alarm if room temperature drops below 45 deg F (adjustable).

3.2 NEW AIR TERMINAL UNITS AND ZONE TEMPERATURE CONTROLS

- A. Project revises existing air terminal units and zone temperature controls in level 2 area of work. Match existing control sequences noted below, and add programming for unoccupied minimum air terminal unit airflow settings for new level 2 office zones as noted on drawings.
- B. Unoccupied airflow settings provide reduced room airflow setpoints to be utilized when the AHU operates in recirculation mode during unoccupied hours when building exhaust fans are off and AHU outside air dampers are closed.

- 3.3 TYPICAL SEQUENCES – EXISTING SEQUENCES TO REMAIN, SEQUENCES PROVIDED FOR REFERENCE – MATCH EXISTING SEQUENCES FOR NEW WORK
- A. Setpoints and delays shall be adjustable. Delays shall be incorporated to prevent short cycles to account for system "inertia", equipment and control device operations, and control system sampling frequency for specified sequence of operations.
- B. Equipment and system operating conditions used for control shall be field adjusted during testing, adjusting, and balancing, and field verified during commissioning.
- C. Typical VAV Air-Handling Unit Fan Speed Control:
1. Locate duct static pressure sensors in main supply air duct, approximately 3/4 the distance between the AHU supply outlet and most remote zone variable air volume (VAV) terminal unit branch duct connection. Suggested locations are shown on the drawings (one per floor). In systems with multiple supply air duct branches, provide a separate static pressure sensor in each main branch duct, located approximately 3/4 of the distance between the AHU supply outlet and the most remote zone terminal unit branch connection.
 2. Compare branch duct pressure readings for each air handling system and control supply fan speed, through the variable speed drive (VSD) controller, to maintain the lowest branch pressure at 1.5 inch W.C. (adjustable) setpoint pressure.
 3. Program VSD such that the air handling unit goes into Full Shutdown Mode in the event of VSD failure. Require manual position on VSD keypad to restart the system. The supply fan operates at 75 percent speed during manual mode.
- D. Typical Zone VAV Temperature Control with Reheat:
1. Zone Sensors: Provide wall-mounted zone thermostat with input to zone VAV terminal equipment controller.
 2. Provide duct-mounted supply-air temperature sensors downstream of each reheat coil.
 3. Occupied Mode Operation:
 - a. Cooling Mode: Modulate the VAV terminal unit control damper between minimum CFM and maximum cooling CFM to maintain zone normal setpoint temperature plus or minus one degree F. Reheat coil control valves remain shut.
 - b. Heating Mode: Modulate the VAV terminal unit control damper between minimum CFM and maximum heating CFM to maintain zone normal setpoint temperature plus or minus one degree F. Modulate VAV reheat coil control valve in parallel with control damper.
 - c. Limit the discharge air temperature to 20 deg F greater than the room temperature.
 4. Unoccupied Mode Operation:
 - a. Heating Mode: When AHU is operating, modulate VAV terminal unit control damper between Minimum CFM and maximum heating CFM to maintain zone setback temperature plus zero, minus three degrees F. Modulate VAV reheat coil control valve in parallel with control damper.
 - b. Cooling Mode: Ventilation system remains off regardless of zone temperature.
- E. Typical Zone Temperature Monitoring:
1. Generate "<location> Zone Temperature High/Low" maintenance alarm if any zone temperature is not being maintained within setpoint band tolerance.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.
- B. This section describes specific requirements, products, and methods of execution, which are typical throughout the electrical work of this project. Additional requirements for the specific systems may modify these requirements.
- C. This Section applies to all Divisions 26, 27 and 28 and is part of all other Divisions 26, 27 and 28 Sections.
- D. Index of Electrical Specifications:
 - 1. 260000 - Electrical General Requirements
 - 2. 260519 - Low Voltage Electrical Power Conductors and Cables
 - 3. 260526 - Grounding and Bonding for Electrical Systems
 - 4. 260529 - Hangers and Supports for Electrical Systems
 - 5. 260533 - Raceway and Boxes for Electrical Systems
 - 6. 260553 - Identification for Electrical Systems
 - 7. 260943 - Network Lighting Controls
 - 8. 262726 - Wiring Devices
 - 9. 262800 - Low Voltage Circuit Protective Devices
 - 10. 265000 - Lighting Fixtures
 - 11. 272010 - Telecom Distribution System
 - 12. 283100 - Addressable Fire Alarm System

1.2 REFERENCES

- A. Codes: Perform work in strict accordance with applicable national, state and local codes; including, but not limited to the latest legally enacted editions of the following specifically noted requirements:
 - 1. NFPA 70, National Electrical Code - NEC.
 - 2. ANSI-C2, National Electrical Safety Code - NESC.
 - 3. International Building Code - IBC.
 - 4. International Fire Code - IFC.
 - 5. Underwriters Laboratory (UL) or approved equal.
- B. Standards: Reference to the following standards infers that installation, equipment and material shall be within the limits for which it was designed, tested and approved, in conformance with the current publications and standards of the following organizations:
 - 1. American National Standards Institute - ANSI.
 - 2. American Society for Testing and Materials - ASTM.
 - 3. American Society of Heating Refrigerating and Air Conditioning Engineers - ASHRAE.
 - 4. Institute of Electrical and Electronics Engineers - IEEE.
 - 5. Insulated Cable Engineers Association - ICEA.
 - 6. National Electrical Manufacturers' Association - NEMA.
 - 7. National Fire Protection Association - NFPA.

1.3 DEFINITIONS

- A. "Accessible" means arranged so that an appropriately dressed man, 6 feet-2 inches tall, weighing 250 pounds, may approach the area in question with the tools and products necessary for the work intended and may then position himself to properly and safely perform the task to be accomplished, without disassembly or damage to the surrounding installation.
- B. "Authority Having Jurisdiction" is the individual official, board, department, or agency established and authorized by the political subdivision created by law to administer and enforce the provisions of the Code as adopted or amended.
- C. "As Specified" denotes a product, system, or installation that:
1. Includes all of the salient characteristics identified in the Drawings and Specifications;
 2. Meets all of the requirements of the "Basis of Design"; and
 3. Is produced by a manufacturer listed as acceptable on the Drawings or in the Specifications.
- D. "Basis of Design" refers to products around which the design was prepared. Some or all of the particular characteristics of Basis of Design products may be critical to the fit or performance of the completed installation. Such characteristics are often subtle. Where substitutions are made to products that are the Basis of Design, the Contractor is alerted that nominally acceptable substitutions may produce undesirable side effects such as switchboards that no longer fit the space due to increased product dimensions. The Contractor is responsible for resolving all impacts of substitutions. Approval of a substitution request does not relieve the Contractor of complying with the design intent and all Codes.
- E. "Contracting Agency" is the Owner as defined in the General Conditions of the Contract.
- F. "Demolish" means to permanently remove a component, equipment, or system and its appurtenances with no intent for reuse and to properly dispose of it.
- G. "Furnish" means to purchase material as shown and specified, and cart the material to an approved location at the site or elsewhere as noted or agreed to be installed by supporting crafts.
- H. "Install" means to set in place and connect, ready for use and in complete and properly operating finished condition, material that has been furnished.
- I. "Product" is a generic term that includes materials, equipment, fixtures and any physical item used on the project.
- J. "Provide" means furnish all products, labor, subcontracts, and appurtenances required and install to a complete and properly operating, finished condition.
- K. "Remove" means to remove a component, equipment, or system and its appurtenances and either store it for re-installation, reuse, or turn it over to the Contracting Agency.
- L. "Rough-in and Connect" means provide an appropriate system connection such as conduit with junction boxes, wiring, switches, disconnects, etc., and wiring connections. Equipment furnished is received, uncrated, assembled, and set in place under the Division in which it is specified.

- M. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction or damage to the surrounding installation. "Serviceable" components shall be "accessible".
- N. "Shop Drawings" are dimensioned working construction drawings drawn to scale to show an entire area of work in sufficient detail to demonstrate service and maintenance clearances and complete coordination of all trades.
- O. "Substitution" is a product, system or installation that is not by a listed manufacturer or does not conform to all salient characteristics identified in the Contract Documents, but which the Contractor warrants meets all specific requirements listed in the Contract Documents.
- P. "System Drawing" is a diagrammatic engineered drawing that shows the interconnection and relationship between products to demonstrate how the products interact to accomplish the function intended. Examples of system drawings include control and instrumentation diagrams, and wiring diagrams. Some drawings, such as dimensioned and complete Fire Suppression Drawings may be both System Drawings and Shop Drawings.

1.4 CONSTRUCTION PHASING REQUIREMENTS

- A. The facility will remain operational throughout the project construction. Project will require construction phasing to minimize impacts to facility operations. Contractor will be required to develop and coordinate construction phasing plans with Owner. Refer to Architectural and Division 1 for additional information.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide labor, products and services required for the complete installation, checkout and startup of electrical systems shown and specified. Where the work of several crafts is involved, coordinate related work to provide each system in complete and in proper operating order.
- B. Lay out the work in advance and avoid conflict with other work in progress. Physical dimensions shall be determined from existing conditions. Verify locations for junction boxes; disconnect switches, stub-ups, etc., for connection to equipment furnished by others, or in other Divisions of this Work.
- C. Refer to the "Suggested Coordination Schedule" in Section 200000 - Mechanical General Requirements.
- D. Cooperate with others involved in the project, with due regard to their work, to promote rapid completion of the entire project.
- E. Coordinate installation of panels, equipment, system components, and other products to provide proper service areas and access for items requiring periodic maintenance inspection or replacement.
- F. Reference to a specific manufacturer's product (even as "Basis of Design") does not necessarily establish acceptability of that product without regard to compliance with all other provisions of these specifications.

- G. Local Conditions: The Contractor shall thoroughly familiarize himself with the work as well as the local conditions under which the work is to be performed. Schedule work with regard to seasons, weather, climatic conditions and other local conditions which may affect the progress and quality of the work.
- H. Demolition: Coordinate related demolition in support of the project. Restore circuits and systems, which are to remain, but which are affected in any way by demolition Work. Conduct a site visit prior to bid to determine Scope. Refer to Part 3 of this Section for execution requirements.

1.6 SUBMITTALS

- A. Refer to Division 1 for general submittal, closeout submittal and product substitution requirements. In addition, prepare Divisions 26, 27 and 28 submittals in accordance with the following.
- B. Specification section drawings, calculations, and products shall be complete and submitted together in one package.
- C. General:
 - 1. The Contracting Agency's obligation to review submittals and to return them in a timely manner is conditioned upon the prior review and approval of the submittals by the Contractor as required by the Construction Contract.
 - 2. Streamlining: in many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.
 - 3. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents.
 - 4. Submittals will not be checked for quantity.
 - 5. Submittals will not be exhaustively checked for dimension or fit, or for proper technical design of manufactured equipment. Provision of a complete and satisfactory working installation is the responsibility of the Contractor.
 - 6. Furnish suppliers with the applicable portions of the Contract Documents and review and verify that the suppliers' submittals clearly represent products which comply with the Contract Documents.
- D. Electronic Submittals:
 - 1. Submittals may be in electronic (PDF) format.
 - a. Electronic submittals shall follow the organization and formatting required for paper submittals.
 - 1). Provide electronic bookmarks within the PDF document in place of tabs and sub-tabs.
 - 2). If individual PDF files are provided for each product or shop drawing sheet, organize files into folders and name files and folders to correspond with applicable specification sections or drawing titles.
 - b. If submittal is a scanned document, run the optical character recognition OCR function to ensure the document is searchable and can be copied and pasted.
 - c. Electronic submittals may be transmitted via Email, disc or download from a project or construction Website.

- E. Coordination:
1. Create and maintain a master submittal log for all items submitted in Divisions 26, 27 and 28.
 2. Prior to submission for approval hold a meeting of all trades to review all shop drawings and submittals. All trades shall cross-check all shop drawings and submittals for conflicts, clearances, physical space allocation and routing, discrepancies, dimensional errors, omissions, contradictions, departures from the Contract requirements, correct electrical/mechanical services and connections, and provisions for commissioning.
 3. Revise, correct, and appropriately annotate submittals prior to submission for approval.
 4. A current copy of approved submittals and the submittal log shall be kept at the job site.
- F. Product Submittals
1. General: This section describes in detail the preparation of electrical product submittals. Submittals not provided as described shall be rejected without review. This procedure is designed to accelerate and improve the accuracy of the technical review process, as well as, simplify the preparation of the Installation, Operation, and Maintenance Manuals (IO&Ms) during project closeout.
 2. Submittal Organization:
 - a. Organize product submittal information in the same order as the products are specified to simplify the technical review process. Provide a separate tabbed divider for each Divisions 26, 27 and 28 specification section. Provide the typed section number on each tab.
 - b. Within each section, organize the product information in the same order as the products are specified in Part 2 of each applicable specification section. Provide sub-tabs within each section for each separate product article. Provide the typed product article number on each tab.
 - c. Provide product submittal information for each product specified in 8-1/2" x 11" format. Fold-out 11" x 17" format is also acceptable.
 - d. If a particular specified product is being omitted from the product submittal or will not be used for the project, provide a single sheet within the article tab identifying the product and annotated with a brief reason why the product is not being submitted, for example: "NOT USED," NO SUBMITTAL REQUIRED," "TO BE SUBMITTED BY (PROVIDE DATE)," etc. This will inform the reviewer that the product was not overlooked.
 - e. Partial submittals from individual subcontractors may be provided which cover a particular sub-contractor's scope of work. In this case, arrange partial submittals by system classification such as: LIGHTING, POWER DISTRIBUTION, FIRE ALARM, ACCESS CONTROL SYSTEM, etc. Within each system classification, arrange product submittals by specification section, as described, such that each specification section can easily be reorganized into a master set of Divisions 26, 27 and 28 product submittals organized by specification section. This will greatly simplify the preparation of IO&M manuals as described below.
 - f. Bind product submittal information in 3 inch wide, hard backed, loose leaf, 3 ring binders with clear front and spine insert pockets. Divide information into multiple volumes such that the pages in each binder rest naturally on one side of rings.
 - g. Provide a master table of contents at the front of each volume which lists the Divisions 26, 27 and 28 specification sections and indicates which sections are located within each volume.
 - h. Provide a table of contents within each section which lists the Part 2 products for that section in the same order as the applicable specification section.
 - i. Provide identical cover and spine inserts for each product submittal volume.

- j. For multiple volumes, label each volume. Include the following typed information on the front cover and spine inserts of each volume:
 - 1). The Contracting Agency Name
 - 2). Project Name
 - 3). Contractor Name
 - 4). Subcontractor Name preparing the submittal.
 - 5). Date that the submittal or resubmittal was initiated.
 - 6). "Electrical Product Submittals", etc. as appropriate.
 - 7). "Volume 1 of X, Volume 2 of X," etc.
 3. Product Information:
 - a. Indicate manufacturer's name and address, and local supplier's name, address, phone number.
 - b. Indicate each product as "Basis of Design", "As Specified" or as "Proposed Substitution."
 - c. Identify Catalog designation and/or model number.
 - d. Neatly annotate each salient characteristic and design options of the product to demonstrate compliance with the Contract Documents to include: Scheduled information, drawing information and specified information. Clearly indicate product deviations from the Contract Documents and mark out non-applicable items on generic "cut-sheets."
 - e. Include manufacturer provided dimensioned equipment drawings with mechanical and electrical rough-in connections.
 - f. Include operation characteristics, performance curves and rated capacities.
 - g. Include motor characteristics and wiring diagrams for the specific system.
 - h. Provide basic manufacturer's installation instructions.
 4. Provide coordination data to check protective devices.
 5. Provide information required to verify compliance with the short circuit withstand and interrupting ratings, as shown on the Drawings or further stated in these Specifications.
 6. Provide certification that all data shown on the Drawings or further stated in these Specifications concerning available short-circuit currents has been confirmed with the serving Electric Utility.
 7. Product Substitutions:
 - a. Clearly indicate both in the section table of contents and on the individual product submittal information each proposed substitution, deviation or change from the product as described in the Contract Documents.
 - b. Submittal approval does not include substitutions, deviations or changes from the requirements of the Contract Documents unless they are specifically itemized and approved. The term "No Exceptions Taken" will not apply to substitutions, deviations or changes not clearly identified.
 - c. Provision of a satisfactory working installation of equal quality to the system as described in the Contract Documents shall be the responsibility of the Contractor.
 - d. Correct unapproved deviations from the Contract Documents discovered in the field as directed by the Contracting Agency at no additional cost to the Owner.
- G. System Drawings:
1. Submit System Drawings for dynamic elements/systems of the project which are performance specified to include but not limited to: Fire Alarm Systems, Lightning Protection Systems and stand-alone packaged equipment.
 2. Prepare system drawings on full sized sheets of the same size as the original construction drawings.

3. Include with each system a sequence of operation narrative which describes each mode of system operation in sufficient detail to demonstrate compliance with the Contract Documents to the satisfaction of the Contracting Agency.
- H. Shop Drawings:
1. General:
 - a. The Contract Documents are not intended for nor are they suitable for use as shop drawings. Do not use Contract Drawings for direct fabrication or installation of products or equipment.
 - b. Divisions 26, 27 and 28 products and systems shall not be installed without shop drawings approved by the Contracting Agency.
 - c. Rework, changes or additional engineering support required as a result of the installation of products and systems prior to the approval of applicable shop drawings by the Contracting Agency shall be provided at the Contractor's expense.
 2. Preparation:
 - a. Review each Divisions 26, 27 and 28 specification section and identify the project's shop drawing requirements.
 - b. Prepare shop drawings on full sized sheets of the same size as the original construction drawings.
 - c. Arrange shop drawings to scale, showing dimensions where accuracy of location is necessary for coordination or communication purposes.
 - d. Incorporate the actual dimensions and configurations of the products and systems approved through the product submittal process into the shop drawings.
 - e. Provide dimensioned maintenance clearance areas around each product as recommended by the manufacturer.
 - f. Meet with and coordinate Divisions 26, 27 and 28 work with the interrelated work of other trades including Architectural, Civil, Structural, and Mechanical to identify and resolve potential conflicts.
 - g. Clearly identify and provide recommendations to resolve major conflicts which may impact the design of the systems as shown. Resolve such conflicts during the shop drawing review process.
 - h. In cases where one or more equipment items in a mechanical or electrical room or space differ in dimensions or configuration from Basis of Design equipment, the working drawing shall show the entire area. The drawing shall be dimensioned to indicate that required aisle ways and maintenance clearances are being maintained to at least the degree shown on the Contract Drawings.
 - i. Provide shop drawings for all products, systems, system components, and special supports that are not a standard catalog product and which may be fabricated for the Contractor or by the Contractor. In addition provide shop drawings for:
 - 1). Electrical and telecommunications rooms and spaces, including all equipment. Demonstrate all required clearances and working spaces are provided.
 - 2). Routing and interdisciplinary coordination of groups of conduits numbering more than one and over two inch trade size.
 - 3). Cable Trays.
 - 4). Telecom equipment rack elevations.
 - 5). Where noted on the drawings.
 - 6). Where noted in other Divisions 26, 27 and 28 sections.

3. Shop Drawing Submittal:
 - a. Submit dimensioned shop drawings as specified to demonstrate proper planning and sequencing of the applicable trades for the installation and arrangement of Divisions 26, 27 and 28 with respect to other interrelated work.
 - b. Installation conflicts arising from the failure to properly coordinate the work of related trades shall be resolved at the Contractor's expense.

- I. Record Drawings
 1. General: As the Work progresses, neatly annotate a designated and otherwise unused, set of Divisions 26, 27 and 28 Contract Drawings to show the actual locations and routing of Divisions 26, 27 and 28 Work and the terminal connection points to related Work. As a minimum, include the following:
 - a. Annotate record drawings to incorporate each applicable addendum.
 - b. Annotate record drawings as directed by each applicable Request for Information (RFI) and accepted Change Order Proposal.
 - c. Modify record drawings to show actual equipment sizes and locations.
 - d. Provide fully dimensioned locations for permanently concealed conduits (i.e. conduit cast in concrete or buried underground/underslab).
 - e. Show routing of work in permanently concealed blind spaces within the building.
 - f. Maintain drawings in an up-to-date fashion in conjunction with the actual progress of installation. Accurate progress mark-ups shall be available on-site for examination by the Contracting Agency or their representative at all times.
 2. Preparation:
 - a. Neatly annotate record drawings to provide clear interpretation to support electronic drafting by a third party.
 - b. Tape electronic sketches from addendums and/or RFIs directly to the record drawings as overlays.
 - c. Annotate the record drawings in colored pencil using the same symbols and abbreviations as indicated in the Divisions 26, 27 and 28 legends and schedules of the Contract Drawings.
 - 1). Red to add information.
 - 2). Green to delete information.
 - 3). Blue to provide additional clarifying information which is not to be drafted.
 - d. After submittal to the Contracting Agency, provide additional clarification, information or rework as necessary to support the accurate interpretation and electronic drafting of the record drawings.
 3. Submittals:
 - a. Provide dimensioned underslab record drawings to the Contracting Agency prior to pouring the slab. For slabs poured in multiple sections, provide record drawings for the applicable slab sections to the Contracting Agency prior to each pour.
 - b. Provide complete record drawings for concealed areas (i.e. above lay-in and hard ceilings and inside walls) to the Contracting Agency prior to concealment.
 - c. Provide the remaining portion of the record drawings for exposed areas to the Contracting Agency prior to the final completion of the project.
 - d. Prepare wiring diagrams for individual special systems as installed. Identify components and show wire and terminal numbers and connections. Include diagrams from the shop drawings and submittals, updated to show as-built condition.

- J. Test Certificates:
 1. Review the submittal requirements for Quality Assurance/Control Submittals for each specification section.

2. Submit copies of design data, test reports, certificates, manufacturer's instructions and field test reports as specified. This information may be included within the Operations and Maintenance (IO&M) Manuals as determined by the Contracting Agency.
- K. Operations and Maintenance (IO&M) Manuals:
1. Provide specific product IO&M information for each section as detailed within each Divisions 26, 27 and 28 section.
 2. Begin the preparation of the electrical Operation and Maintenance Manuals with a complete and fully approved set of electrical product submittals organized, annotated and with the product information as indicated within the "Product Submittals" article for each specification section.
 3. Next, augment each individual product submittal with the written installation, operations and maintenance information for each specific product. Obviously, this type of information is not applicable (or available) for bulk commodity or simplistic products such as conduit or equipment tags, etc.
 4. Maintenance information shall include:
 - a. Preventive maintenance requirements for each product, including the recommended frequency of performance of each preventive maintenance task.
 - b. Instructions for troubleshooting, minor repair and adjustments required for preventive maintenance routines, limited to repairs and adjustments that may be performed without special tools or test equipment and that require no extensive special training or skills.
 - c. Information of a maintenance nature covering warranty items, etc., that have not been discussed in the manufacturers' literature.
 - d. Information data for spare and replacement parts for each product and system. Properly identify each part by part number and manufacturer.
 - e. Recommended spare parts list.
 5. Organize the Operation and Maintenance Manual information by specification section (not by sub-contractor) with a tabbed divider separating each section. Provide the typed section number on each tab.
 6. Within each section, organize the product information in the same order as the products are specified in Part 2 of each applicable section. Provide sub-tabs within each section for each product. Provide the typed product article number on each tab.
 7. Bind the information in identical, 3 inch wide; hard backed loose leaf 3 ring binders with clear front and spine insert pockets. Divide information into multiple volumes so that the pages in each binder rest naturally on one side of rings.
 8. Provide a master table of contents at the front of each volume which lists the Divisions 26, 27 and 28 specification sections and indicates which sections are located within each volume.
 9. Provide a table of contents within each section which lists the Part 2 products for that section in the same order as the applicable specification section.
 10. Provide identical cover and spine inserts for each IO&M manual volume.
 11. For multiple volumes, label each volume.
 12. Include the following typed information on the front cover and spine inserts of each volume:
 - a. The Contracting Agency Name.
 - b. Project Name.
 - c. "Electrical Operations and Maintenance Manual".
 - d. "Volume 1 of X, Volume 2 of X," etc.
 13. Submit copies of all Operation and Maintenance Manuals in electronic format (Adobe PDF).

1.7 QUALITY ASSURANCE

- A. Qualifications: Perform the Work using qualified workmen that are experienced and usually employed in the trade.
- B. Product Testing and Certification:
1. Nationally Recognized Testing Laboratory (NRTL) Labeling: Electrical equipment and conductors shall be “Approved,” “Certified,” “Identified,” or “Listed” and “Labeled” to establish that the electrical equipment is safe, free of electrical shock and fire hazard, and suitable for the purpose for which it is intended to be used. The manufacturer shall have the specific authorization of one of the Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratories (NRTLs) in accordance with the applicable national standards to label the equipment as suitable.
 2. Further details on the specific NRTLs, as well as the product standards that they are specifically recognized to evaluate equipment in accordance with, can be found on the OSHA Web site: <http://www.osha.gov/dts/otpca/nrtl/>
- C. Drawings and Specifications:
1. The Drawings and specifications are complementary. Do not scale the Drawings. Locations of devices, fixtures, and equipment are approximate unless dimensioned.
 2. The Drawings are partly diagrammatic and do not show precise routing of conduits or exact location of all products, and may not show in minute detail all features of the installation; however, provide all systems complete and in proper operating order.
 3. Drawing symbols used for basic materials, equipment and methods are commonly used by the industry. Special items are identified by a supplementary list of graphical illustrations, or called for on the Drawings or in the specifications.
- D. Tests and Inspections:
1. Schedule, obtain, and pay for permits and fees required by local authorities and by these specifications.
 2. Request for Tests: Notify the Contracting Agency a minimum of 72 hours in advance of tests. In the event the Contracting Agency does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.
 3. Deficiencies: Immediately correct deficiencies that are evidenced during the tests and repeat tests until system is approved. Do not cover or conceal electrical installations until satisfactory tests are made and approved.
 4. Operating Tests: Upon request from the Contracting Agency, place the entire electrical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.
 5. The Contracting Agency may inspect and approve sample installation of systems and equipment prior to general installation of units.
 6. Test Witness: Arrange for the Contracting Agency to witness tests. The Contracting Agency may waive witnessing any specific test at its discretion.

1.8 WARRANTY

- A. Warranty work shall be promptly coordinated and performed at the Contractor's sole expense. Workmanship, labor and materials (without limitation) in this Division shall be warranted for the longer of the following:
1. As called for in the General Conditions of the Contract.
 2. For a minimum period of one year from the date of final acceptance.
 3. For the extended warranty period specified in a specific Section under this Division.

- B. Where a specific product carries a longer warranty as a standard offering of its manufacturer, extended warranty coverage beyond these requirements shall be retained by the Owner. The Owner will have recourse back to the manufacturer only in these cases, when the warranty as specified in A above has expired.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT FURNISHED IN DIVISIONS 26, 27 AND 28

- A. Materials furnished and installed in permanent construction shall be new, full-weight, standard in every way, and in first class condition.
- B. Materials shall conform to the standards of an organization acceptable to the Authority Having Jurisdiction and concerned with product evaluation that maintains periodic inspection of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner. Only materials designed for the purpose employed shall be used.
- C. Materials shall be identical with apparatus or equipment that has been in successful operation for at least two years. Materials of similar class or service shall be of one manufacturer.
- D. Capacities, sizes, and dimensions given are minimums unless otherwise indicated. Systems, materials and equipment proposed for use on this project shall be subject to review for adequacy and compliance with Contract Documents.

2.2 MATERIALS AND EQUIPMENT FURNISHED IN OTHER DIVISIONS

- A. Controls, including conduit, wiring, and control devices required for the operation of systems furnished in other Divisions shall be provided complete under the Division of the Specifications in which the equipment is specified, unless otherwise noted or specified.
- B. Work on the project that falls under the jurisdiction of the electrical trade shall be performed by Licensed Electricians in conformance with the electrical specifications.
- C. Provide complete power connections to equipment including but not limited to feeders, connections, disconnects and motor running overcurrent protection. Where starters are provided as part of packaged equipment, overcurrent heaters shall be provided under Divisions 26, 27 and 28.

PART 3 - EXECUTION

3.1 COORDINATION WITH ROOM NUMBERING

- A. Certain systems provided under this Division rely on identification systems that are based on room names or numbers. Systems labeled in this fashion include, but are not limited to, panelboards, circuit directories, communication and data systems identifiers, fire alarm systems, etc.

- B. The numbering scheme indicated in these Contract Documents is based on room numbers assigned during the design process. The Owner reserves the right to change the numbers prior to substantial completion, and the final names and numbers will not necessarily match those found in the Documents. Obtain from the Owner the final room numbers prior to commencing the numbering of Divisions 26, 27 and 28 systems. Tag and label all system circuits and devices in accordance with the final numbering scheme at no additional cost.

3.2 INSTALLATION

- A. Skilled craftsmen shall install materials and equipment. The norms for execution of the work shall be in conformity with NEC Chapter 3 and the National Electrical Contractors' Association "National Electrical Installation Standards", which herewith is made part of these specifications.
- B. Repair surfaces and furnish all required material and labor to maintain fireproof, airtight and waterproof characteristics of the construction.
- C. Installation of equipment shall be in accordance with manufacturers' instructions.

3.3 MULTIWIRE BRANCH CIRCUITS

- A. Multiwire branch circuits shall not be used on this project. Each branch circuit shall be provided with its own dedicated neutral conductor.

3.4 MOUNTING HEIGHTS

- A. Mounting height shall be to center of box above finished floor (AFF) as noted below unless otherwise shown or indicated. Other mounting heights are indicated on the Drawings by detail. Specific dimensions AFF are shown adjacent to the symbol. Where devices are shown on architectural elevations, the elevation height shall govern.

Lighting switches	48 inches
Convenience outlets and similar devices	18 inches (see note below)
Convenience outlets in mechanical, boiler rooms and workrooms	48 inches
Motor controllers	60 inches to top
Panelboards	76 inches to top
Exterior WP convenience outlets	24 inches AFG
Telecommunications (Data/Telephone) outlets	18 inches (see note below)
Wall mounted audible and/or visual appliances such as bells, horns, strobes and similar signal devices	90 inches (or 6 inches below ceiling height for ceiling heights less than 96 inches)
Manual fire alarm box	48 inches (or 48 inches to operable part where operable part of device is above centerline of device)
Security Card Reader	48 inches to center

NOTE: In locations where baseboard-heating enclosures are to be installed, outlet-mounting height shall be raised to 6 inches above top of enclosure unless otherwise noted on drawings.

3.5 CUTTING & PATCHING

- A. Obtain written permission of the Contracting Agency before cutting or piercing structural members.
- B. Wall and floor penetrations shall be in accordance with Section 260529 - Hangers and Supports.
- C. Holes through existing concrete shall be core drilled. X-ray concrete before core drilling. Do not cut rebar without specific authorization from the Contracting Agency. Seal openings with UL Listed fire resistant resilient sealant.

3.6 VAPOR RETARDER/BARRIER PENETRATIONS

- A. Provide solid blocking installed flat at all vapor retarder penetrations. Provide flat blocking at the interior face of the exterior stud wall. Blocking shall be a minimum of 4 inches larger than the penetration. Locate the penetration at the centerline of the flat blocking. Secure vapor retarder to blocking.
- B. Seal the interior of raceways penetrating the vapor retarder inside the building. Between point of sealing inside of raceway (typically at junction box or conduit) and vapor retarder penetration, seal conduit joints (connectors and couplings) with vapor retarder tape, paint on sealer or approved means acceptable to Contracting Agency.
- C. To reduce thermal transfer and ensure sealing of raceway, PVC or equivalent conduit shall be used where penetrations of building envelope are made above ground where installation of PVC is allowed by NEC.
- D. Penetrations of the building vapor retarder/barrier caused by the electrical installation shall be minimized, and where they are required, the opening in the vapor retarder/barrier shall be cut smaller than the penetrating object, so that the penetration will be a stretch fit. The penetration shall then be securely sealed with vapor barrier tape or an adhesive or caulk compatible with the surfaces being sealed.
- E. Boxes (electrical boxes, outlet boxes and telecommunication boxes, etc) penetrating walls with vapor retarder/barriers shall be sealed airtight using STI Series SSP Firestop Putty Pads. Mold putty pads around electrical junction boxes and conduits and behind vapor retarder/barrier to form an airtight seal in accordance with manufacturer's installation instructions.

3.7 FIRE RESISTIVE CONSTRUCTION

- A. Provide "tenting" or other protection acceptable to the Authority Having Jurisdiction for devices or fixtures installed in fire resistive construction (i.e., ceilings, walls, etc.) to maintain the fire resistive rating of the complete assembly.

- B. Where electrical raceways or other features penetrate fire rated building surfaces, they shall maintain the integrity of the building surface being penetrated. This shall be accomplished with either of the following methods:
 - 1. Sealing the penetration with an approved fire rated caulk or putty.
 - a. Fire rated caulk or putty: 3M Fire Barrier Caulk No. CP25, 3M Fire Barrier Moldable Putty, or as approved.
 - 2. A fire rated assembly enclosing the penetration.
 - a. Fire rated assembly: STI EZ Path, or as approved.
 - 3. Firestopping shall be applied according to the manufacturer's recommendations, and in a manner that is listed by a nationally recognized independent testing agency (such as UL) as preserving the fire time rating of the construction.

3.8 SOUND ISOLATION

- A. Where electrical raceways or other features penetrate walls that extend to structure, they shall maintain the integrity of the building surface being penetrated. Refer to the requirements of FIRESTOPPING as specified above. Note that this requirement exists regardless of whether the building surface being penetrated has a fire rating.
- B. Boxes (electrical boxes, outlet boxes and telecommunication boxes, etc) penetrating wall types that extend to structure or that contain batts shall be sealed airtight using STI Series SSP Firestop Putty Pads to reduce sound transmission. Mold putty pads around electrical junction boxes and conduits to form an airtight seal in accordance with manufacturer's installation instructions.

3.9 PROTECTIVE FINISHES

- A. Take care not to scratch or deface factory finish of electrical apparatus and devices. Repaint all marred or scratched surfaces.
- B. Provide hot dip galvanized components for ferrous materials exposed to the weather.

3.10 SEPARATION OF SYSTEMS

- A. Conductors and equipment of different voltage levels, frequency, current characteristics (AC & DC) or functions (normal vs. emergency, etc.) shall not share the same raceways or enclosures unless specifically shown on the Drawings or approved by the Contracting Agency, or inherently necessary for correct system function (i.e., at transfer switches, transformers, etc.)

3.11 TESTING

- A. Prior to final test, switches, panelboards, devices and fixtures shall be in place.
- B. Test electrical systems. They shall be free from short circuits and unintentional grounds.
- C. Make changes necessary to balance the actual electrical loads on the complete system. Arrange for balanced conditions of circuits under connected load demands, as contemplated by the normal working conditions. Final load and balance test shall be demonstrated in the presence of the Contracting Agency.

- D. Feeder cables and branch circuit cables larger than #4 AWG shall be megger tested prior to final termination. If conductor fails test, replace wiring or correct defect and retest. Perform a 1,000 volt megohm meter test between the following circuit cables in each raceway:
1. A phase and B phase conductors
 2. A phase and C phase conductors
 3. B phase and C phase conductors
 4. A phase and Grounded (Neutral) conductors
 5. B phase and Grounded (Neutral) conductors
 6. C phase and Grounded (Neutral) conductors
 7. A phase and Equipment Grounding conductors
 8. B phase and Equipment Grounding conductors
 9. C phase and Equipment Grounding conductors
 10. Grounded (Neutral) and Equipment Grounding conductors
- E. Feeder cables shall be megger tested prior to final termination. If conductor fails test, replace wiring or correct defect and retest. Perform a 1,000 volt megohm meter test on each circuit cable rated 600 volts between the conductor and ground. Submit logs of megger readings. The insulation resistance between conductors shall not be less than 100 Megohms.
- F. Furnish one (1) copy of certified test results to the Contracting Agency prior to final inspection.

3.12 STORAGE AND HANDLING

- A. Items shall be delivered and stored in original containers, which shall indicate manufacturer's name, the brand, and the identifying number. Items subject to moisture and/or thermal damage shall be stored in a dry, heated place. Items shall be covered and protected against dirt, water, chemical, ultraviolet (UV) and/or mechanical damage.

3.13 PROTECTION OF MATERIAL AND EQUIPMENT

- A. The Contractor shall be responsible for materials and equipment to be installed under this Contract. The Contractor shall make good at his own cost any injury or damage which said materials or equipment may sustain from any source or cause whatsoever before final acceptance.
- B. Cover and protect electrical equipment during construction from dust, dirt, debris, overspray, or other construction contaminates.

3.14 CLEANING AND REPAIR

- A. Throughout the work, the Contractor shall keep the work area reasonably neat and orderly by frequent periodic cleanups.
- B. Prior to substantial completion, clean equipment and systems used during construction.
- C. Repair surfaces damaged or impacted by the work. Restore to original condition or better. Retexture surfaces to match surrounding surfaces. Repaint affected surfaces, with extent of paint to include adjacent surfaces to next wall or other clean break to avoid mismatched finish.
- D. As independent parts of the installation are completed, they may be tested and utilized during construction.

3.15 ACCESS DOORS

- A. Provide access doors required for access to equipment provided under Divisions 26, 27 and 28. Doors shall be rated for the surrounding construction. Use of access doors shall be minimized, and all locations and cosmetic features shall be submitted for approval in advance.
- B. Doors shall be finished to match surrounding surfaces as approved by the Contracting Agency.

3.16 DEMOLITION

- A. Examination Prior to Bid: Drawings involving existing conditions are based on building record drawings and/or limited field observation. Conduct a site inspection prior to submission of Bid to become thoroughly familiarized with the Scope of Work. Report discrepancies to Contracting Agency. Submission of bid certifies acceptance of existing conditions.
- B. Examination Prior to Start of Demolition: Conduct a thorough site inspection before disturbing existing installation. Verify field measurements and circuiting arrangements. Verify that abandoned wiring and equipment serve only abandoned facilities. Beginning of demolition certifies acceptance of existing conditions.
- C. Preparation:
 - 1. Disconnect electrical systems in walls, floors, ceilings, etc., scheduled for removal.
 - 2. Coordinate utility service outages with utility companies and Contracting Agency.
 - 3. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
 - 4. Existing Electrical Service: Maintain existing systems in service until new systems are complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Contractor shall not be entitled to any additional compensation due to inability of Owner to grant an outage at the desired time. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
 - 5. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and applicable Fire Department Authorities at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- D. Demolition of Existing Electrical Work:
 - 1. Remove, relocate, and extend existing installations to accommodate new construction.
 - 2. Remove abandoned wiring to source of supply.
 - 3. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut concealed conduit flush with walls and floors, and patch surfaces.
 - 4. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets, which are not removed. In finished areas, blank covers shall be blank plates matching the device plates specified for new work, unless otherwise noted or specified.
 - 5. Disconnect and remove abandoned panelboards and distribution equipment.
 - 6. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

7. Disconnect and remove abandoned light fixtures. Remove brackets, stems, hangers, and other accessories.
 8. Repair adjacent construction and finishes damaged during demolition and extension work.
 9. Maintain access to existing electrical installations that remain active. Modify installation or provide access panels as appropriate.
 10. Restore circuits and systems to remain that are affected in any way by demolition Work, such as loads downstream of demolished equipment, switched lighting circuits where selected fixtures are demolished, etc.
 11. Salvage or disposal of removed items shall be as noted on the Drawings or as directed by the Contracting Agency. Items, which the Owner does not desire to retain, shall be disposed of at a legal disposal site.
- E. Cleaning and Repair:
1. Clean and repair existing materials and equipment that remain or are to be reused or are affected by this work.
 2. Panelboards: Clean exposed surfaces and interior of cabinet and retorque electrical connections. Provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
 3. Light Fixtures: Remove existing light fixtures for cleaning. Use mild detergent to clean exterior and interior surfaces; rinse with clean water and wipe dry

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes specific requirements, products, and methods of execution relating to wire and cable, 600 volts or less, approved for use on this project.
- B. Related Sections
 - 1. 260533 - Raceways and Boxes for Electrical Systems
 - 2. 260553 - Identification for Electrical Systems

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

1.3 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.

1.4 QUALITY ASSURANCE

- A. Conductors shall be sized according to American Wire Gauge (AWG). Stranding, insulation, rating and geometrical dimensions shall conform to UL and ICEA specifications.

PART 2 - PRODUCTS

2.1 INSULATION TYPES

- A. Branch circuit conductors shall be 600 volt insulated, and unless otherwise noted on the Drawings, shall have the following insulation types:
 - 1. Heated indoor spaces - THHN/THWN or XHHW.
 - 2. Indoor/outdoor between VSD and motor – XHHW.
 - 3. Outdoors, wet locations (such as slab-on-grade), or other cold locations (such as unheated attics) - XHHW.
- B. Feeder conductors shall be 600 volt insulated, and unless otherwise noted on the Drawings, shall have the following insulation types:
 - 1. Heated indoor spaces - THHN/THWN or XHHW-2.

2. Outdoors, wet locations (such as slab-on-grade), or other cold locations (such as unheated attics) - XHHW-2.
- C. Nylon-jacketed conductors such as Types THHN or THWN shall not be used in any location subject to ambient temperatures below 20° F.
- D. Special applications: Conductors in fluorescent fixture wiring channels shall have 90° C insulation rating, Types THHN, XHHW, or equal. Conductors in high temperature locations shall have one of the special insulation types suitable for the use and as permitted by the NEC.
- E. Conductors feeding Variable Frequency Drives (VFDs) and between VFDs and equipment supplied by the VFDs shall be Type XHHW-2.

2.2 MC CABLE

- A. Where concealed, type MC (metal clad) cable is acceptable on this project for branch circuit wiring. Type MC cable shall not be used for branch circuit homeruns. Homerun shall be considered to originate within 10 feet of the last device or fixture connection or as approved by the Contracting Agency.
- B. Type MC (metal clad) cables shall have integral code-sized grounding conductor.
- C. Type MC cable shall consist of a factory assembly of one or more conductors, each individually insulated and enclosed in a metallic sheath of interlocking tape or a smooth corrugated tube.

2.3 TYPE FPLP/MC CABLE

- A. In existing non-accessible spaces, where required to be fished, Type FPLP/MC metal clad fire alarm/control cable is acceptable on this project. Cable shall be UL Listed as Type FPLP Metal Clad/Power limited fire-protective signaling cable - FPLP (105°C) / MC (90°C). Submit for approval, prior to installation, all intended applications. Cable installed without prior approval is subject to removal at the Contractor's expense at the discretion of the Contracting Agency.
- B. Type FPLP/MC technical specifications:
 1. Armor: Galvanized steel (red striped).
 2. Conductors: Solid copper (number as required for application).
 3. Conductor insulation: TFN/THHN.
 4. Assembly covering: Polypropylene tape.
 5. Maximum temperature rating: FPLP 105°C (dry); MC 90°C (dry).
 6. Grounding: Bare grounding conductor.
 7. Maximum voltage rating: FPLP 300V; MC 600V.
 8. Minimum conductor size: 18 AWG.
- C. Fittings for use with Type FPLP/MC metal clad fire alarm/control cable shall be designed specifically for use with Type FPLP/MC and manufactured by the producer of the Type FPLP/MC cable.

2.4 FLEXIBLE CORD

- A. Flexible cord shall be Type SO or ST, or for the larger sizes, Type G.

2.5 MISCELLANEOUS

- A. Miscellaneous: Miscellaneous wire and cable for special purpose applications and not covered in the categories as indicated above or otherwise specified, shall be as shown on the plans and/or required by the intended use.

2.6 MINIMUM SIZE

- A. Unless specified otherwise minimum wire sizes shall be as follows:
1. #12 AWG for branch circuit wiring.
 2. #20 AWG for low voltage switching circuits if part of an approved cable assembly, #18 AWG otherwise.
 3. #14 AWG for control circuit wiring.
 4. #16 AWG for light fixture whips, refer to specification section 260533 - Raceway and Boxes for Electrical Systems, for maximum fixture whip lengths.
- B. On 20A circuits, with one-way conductor lengths measured from panel to farthest receptacle, or center of lighting string (as applicable):
1. #10 AWG for 120V circuits of 75 feet to 120 feet.
 2. #8 AWG for 120V circuits of 120 feet to 200 feet.
 3. #10 AWG for 277V circuits of 130 feet to 215 feet.
 4. #8 AWG for 277V circuits of 215 feet to 330 feet.
- C. Similar oversizing shall apply to circuits of other ratings and/or greater lengths, as necessary to comply with the voltage drop limitations in Part 3 of this Section.
- D. Cable or conductors for fire alarm systems and other special systems shall be as described in other sections of the specifications, noted on the drawing, or recommended by the equipment manufacturer, whichever is greater.

2.7 CONDUCTORS

- A. Conductors used on this project shall be copper, solid or stranded for wiring #10 and smaller, stranded for #8 and larger.
- B. Stranded control, communication, and alarm conductors shall have compression terminations where terminated on screw terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unless otherwise noted or specified, all conductors shall be run in raceways as specified in Section 260533 – Raceways and Boxes for Electrical Systems. Raceways shall be installed as a complete system, free from obstructions, and clean before conductors are installed.
- B. Provide conductors from outlet to outlet and splice branch circuit conductors only at outlet or junction boxes. Install all conductors in a single raceway at one time and leave sufficient cable

at all fittings or boxes. Keep conductors within the manufacturer's allowable tension. Do not violate minimum bending radii. Lubricants for wire pulling, if used, shall conform to UL requirements for the insulation and raceway material.

- C. Do not install Type XHHW conductors in temperatures below -10° F, or the other types in temperatures below +20° F.
- D. Conductors that extend below grade shall be suitable for wet locations (type XHHW or XHHW-2). The use of THHN below grade is not acceptable.

3.2 CONDUCTOR SUPPORT

- A. Provide conductor supports as recommended by the NEC or cable manufacturer in vertical conduits.

3.3 SPLICING

- A. No splicing or joints are permitted in branch circuits except at outlet or accessible junction boxes. Prior to splicing, conductors shall be stripped to the exposed length recommended by the splicing device manufacturer.
- B. Utilize compression type solderless connectors when making splices or taps in conductors No. 8 AWG or larger. Provide heat or cold shrink type insulating tubing on splices and tape outer surface continuously with Scotch #88 plastic tape to secure insulation strength equal to that of the conductors joined.
- C. Utilize pre-insulated connectors, hard-shell type only, Ideal Industries, Inc., "Wing-Nut" or "Twister Pro" or "In-Sure Push-in Connectors" for splices and taps in conductors No. 10 AWG and smaller in dry locations.
- D. Utilize Ideal "Twister DB Plus", water repellent, sealant filled, UL 486D Listed connector splices and taps in conductors No. 10 AWG and smaller in damp or wet locations.
- E. Utilize "Buchanan pre-insulated crimp connectors" on stranded conductors for fire alarm control and alarm circuits.
- F. Feeder conductors shall be installed with no splices unless otherwise noted on the Drawings. Splices in feeder conductors, where specifically allowed, shall be compression type butt splices.

3.4 CONDUCTOR TERMINATION

- A. Provide power and control conductors that terminate on equipment or terminal strips with solderless lugs or T & B "Sta-Kon" terminals.
- B. Prior to termination, conductors shall be stripped to the exposed length recommended by the termination device manufacturer.

3.5 CONDUCTOR PHASE COLOR CODING

- A. Service, feeder and branch circuit conductors throughout the project secondary electrical system shall be color coded as follows:

208/120 Volts	Phase	480/277 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray (see following)
Green	Ground	Green

- B. Where color coded conductors are not commercially available, colored non-aging, plastic tape may be utilized where permitted by NEC.
- C. Where neutrals of different systems exist on the project, neutral conductor identification method shall satisfy the Authority Having Jurisdiction, as to compliance with NEC Article 200. Branch circuit neutral conductors shall have a color stripe matching the corresponding phase conductor where neutral is not shared.
- D. Phases in panelboards and similar equipment shall be connected Phase A, B, C from left to right, top to bottom, or front to back.

3.6 DERATING OF CONDUCTORS

- A. Derating of conductors shall be per National Electrical Code.

3.7 VOLTAGE DROP

- A. The maximum total voltage drop shall not exceed three (3) percent in branch circuits or feeders, for a total of five (5) percent to the farthest outlet based on steady state design load conditions. Wire sizes shown on the Drawings are for minimum ampacity. Wire and conduit sizes shall be increased to limit voltage drop based upon actual lengths required in the field. Base voltage-drop calculations on NEC Chapter 9, Table 9.
- B. Secondary transformer voltage taps may be used to offset voltage drop as long as no load voltage does not exceed 125 volts phase to neutral/ground at transformer secondary.

3.8 OPEN WIRING ABOVE LAY-IN CEILINGS PROHIBITED

- A. Wiring for all systems shall be installed in one of the raceway systems or cable tray systems listed for this project. Refer to the Drawings and the specific Section under which each system is specified.
- B. Wiring installed in cable trays in air-handling ceiling spaces shall be approved for the application and the specific system.

- C. Raceways and sleeves shall be sized in accordance with the cabling requirements for the special system involved.

3.9 TESTING

- A. Feeder and branch circuit cables larger than #4 AWG shall be megger tested prior to final termination in accordance with Section 260000 – Electrical General Requirements.

3.10 FIELD QUALITY CONTROL

- A. Document each installation and operational step utilizing the approved PC/FC checklists in accordance with Section 019100 - Commissioning.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes general requirements, products and methods of execution relating to the furnishing and installation of a complete grounding system as required for this project.

1.2 REFERENCES

- A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only, latest edition.

NUMBER	TITLE
ANSI/IEEE C2	National Electrical Safety Code
ANSI/NFPA 70	National Electrical Code
ANSI/TIA/-606-C	Administration Standard for Commercial Telecommunications Infrastructure
ANSI/TIA-607-C	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
IEEE C62.41	Recommended Practice on Surge Voltages in Low-Voltage Surge Protective Devices
IEEE C62.42	Guide for the Application of Gas Tube Arrester Low-Voltage Surge Protective Devices
IEEE Draft P1250 (D4)	Guide on Service to Equipment Sensitive to Momentary Voltage Disturbances
IEEE Std 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
IEEE Std 142	Recommended Practice for Grounding of Industrial and Commercial Power Systems
IEEE STD 81	Recommended Guide for Measuring Ground Resistance and Potential Gradients in the Earth
NFPA 70	National Electric Code (NEC) - Codebook and Handbook
REA PE-33	(1985) Shield Bonding Connectors
UL 1449 Edition 3	Surge Protective Devices (SPDs)
UL 467 Edition 6	Grounding and Bonding Equipment
UL 497 Edition 5	Protectors for Paired Conductors for Communication Circuits
UL 497A Edition 1	Secondary Protectors for Communication Circuits
UL 497B Edition 1	Protectors for Data Communication and Fire Alarm Circuits

1.3 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1. Include copies of catalog cuts, data sheets and other descriptive information for all specified materials.

1.4 MINIMUM REQUIREMENTS

- A. The minimum requirements for the system shall conform to Article 250 of the NEC.

1.5 SPECIAL REQUIREMENTS

- A. Unless specified elsewhere, the ohmic values for grounds and grounding systems from system to earth shall be as follows:
 - 1. For grounding metal enclosures and frames for electrical and electronically operated equipment -- 5 ohms maximum.
 - 2. For grounding systems to which electrical utilization equipment and appliances are connected -- 5 ohms maximum.
 - 3. For grounding secondary distribution systems, neutrals, noncurrent carrying metal parts associated with distribution systems, and enclosures of electrical equipment not normally within reach of other than authorized and qualified electrical operating and maintenance personnel -- 10 ohms maximum.

PART 2 - PRODUCTS

2.1 CONNECTIONS

- A. Clamps, lugs, connectors, bonding bushings, and other such grounding and bonding items shall be:
 - 1. Labeled or listed for the purpose.
 - 2. Shall be made (both body and hardware) of hot dip galvanized steel, bronze, or other corrosion resistant alloy (except bushing throats shall be plastic).
 - 3. Shall be the products of O-Z/Gedney, T & B, Raco, or accepted equals.
 - 4. In outdoor, damp, or corrosive environments, metals for these items shall be copper (with or without tin-plating), bronze, or other corrosion resistant alloys only; O-Z/Gedney or accepted equal.

2.2 TELECOMMUNICATIONS GROUNDING AND BONDING SYSTEMS

- A. Bond telecommunication racks and/or cabinets, ladder racks, cable trays, conduits, and all other telecommunication room and equipment room metallic components to either a PBB or SBB with a green TEBC with a minimum specification of #6 AWG, 600-volt, insulated copper conductor.
- B. Bond telecommunication equipment located within a telecommunication rack or cabinet to a local RBB with an UBC with a minimum specification of #6 AWG, 600-volt, insulated copper conductor. Each piece of equipment shall be connected back to the local RBB in a radial configuration, i.e., equipment ground connections shall not be "daisy chained".

2.3 IDENTIFICATION AND LABELING

- A. Grounding conductors shall be labeled in accordance with Specification Section 260553 and TIA/EIA-606-C.

PART 3 - EXECUTION

3.1 EQUIPMENT GROUND

- A. The raceway system shall be bonded in conformity with NEC requirements to provide a continuous ground path. Where required by Code or Ordinance or where called for on the plans an additional grounding conductor shall be provided, sized in conformity with Table 250.122 of the NEC, unless larger size is noted.
- B. Provide separate grounding conductor securely bonded and effectively grounded to the enclosures at both ends of all non-metallic raceways and all flexible conduit.
- C. Provide an equipment grounding conductor sized in conformity with Table 250.122 of the NEC, unless larger size noted, for new feeder and branch circuit conduits. Where conductors are adjusted in size to compensate for voltage drop, equipment grounding conductors shall be adjusted proportionately according to circular mil area.

3.2 CONCEALED CONNECTIONS

- A. Permanent grounding connections, where permitted by the NEC to be concealed, shall not be so concealed until inspected and accepted by the Contracting Agency. Failure to comply with this requirement shall make the Contractor liable for all expenses incurred in the process of re-exposing the connections for inspection, and subsequent repair and patching of the concealing construction, including the work of other trades. The Contractor shall schedule inspection of such connections at least one work week in advance of concealment, and shall not be entitled to any additional compensation or time extension for delays caused by inability of the Contracting Agency's representative to be available at the desired time.

3.3 CORDS AND NONMETALLIC CABLES

- A. Unless specifically permitted otherwise, cords and nonmetallic cables shall be furnished with integral Code-sized grounding conductor. Securely bond metal components and effectively ground the entire electrical system.

3.4 TELECOMMUNICATIONS GROUNDING AND BONDING SYSTEMS

- A. Alternating Current Equipment Ground (ACEG): When an electrical panelboard is located in the same room or space as the PBB or an SBB, that panelboard's ground bus shall be bonded to the PBB and/or SBB with an ACEG.
- B. Conductors
 - 1. Where insulated, the TBC and each TBB, BBC, TEBC, and UBC, shall be green, green with yellow stripe, or marked with a distinctive green color.

C. Bonding and Connections:

1. General:
 - a. Insulated wire splices shall be insulated with preformed wire covers.

D. Identification and Marking:

1. Show conductors on neatly marked record drawings. Submit to the Contracting Agency.
2. Grounding conductors shall be marked per ANSI/TIA/EIA 606-C and as directed by the Contracting Agency. Mark each cable end using tie wrap style cable markers.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. General hanger and support requirements for electrical equipment, conduit and cable trays not required to be vibration and/or seismically controlled.
 - 2. Penetrations, sleeves and seals.
- B. Products Installed But Not Supplied Under this Section:
 - 1. Vibration Isolation and Seismic Control anchoring and support systems furnished under Section 200548 – Mechanical Vibration and Seismic Control.
- C. Related Sections:
 - 1. 019100 - Commissioning
 - 2. 200548 - Mechanical Vibration and Seismic Control
 - 3. 260000 - Electrical General Requirements
 - 4. 260533 - Raceways and Boxes for Electrical Systems
 - 5. 265000 - Lighting Fixtures
 - 6. 272010 - Telecom Distribution System
 - 7. Division 09 - Painting

1.2 REFERENCES

- A. NFPA 70: National Electrical Code (NEC) latest legally enacted edition.

1.3 DESCRIPTION

- A. Provide general hanger and support requirements for electrical equipment, conduit and cable trays not required to be vibration and/or seismically controlled in accordance with the manufacturer's written installation instructions and NFPA 70.
- B. Coordinate directly with Section 200548 – Mechanical Vibration and Seismic Control – Mechanical Vibration and Seismic Control to identify electrical equipment and systems which require vibration and/or seismic control bracing in addition to the requirements of this section.

1.4 SUBMITTALS

- A. See Section 260000 - General Electrical Requirements for general submittal requirements
- B. Product Data:
 - 1. Provide manufacturers catalog data for each product specified. Indicate channel gauge and maximum load capacities of the selected products.
 - 2. Manufacturer's Installation Instructions: Include assembly instructions, recommended parts and special procedures as required.

C. Shop Drawings:

1. Provide a single shop drawing submittal which integrates the shop drawing requirements of this section along with the additional requirements of Section 20 0548 – Mechanical Vibration and Seismic Control – Mechanical Vibration and Seismic Control.
2. Provide shop drawings to include the following:
 - a. Pre-engineered and field fabricated support system details for each installation location. To include but not limited to:
 - 1). Raceway and lighting fixture support.
 - 2). Conduit and control panel support.
 - 3). Cable tray and switch box support.
 - 4). Cable tray support (single and multi-tier).
 - 5). Trapeze hangers.
 - 6). Electrical equipment support.
 - b. Equipment locations and conduit and cable tray routing coordinated with mechanical equipment and systems. Indicate routing height above finished floor.
 - c. Indicate hanger type/attachment method and hanger spacing intervals.

D. Project Record Information:

1. Indicate installed locations of hangers and supports on project as-built shop drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site:

1. Verify products are delivered in original factory packaging and are free from damage and corrosion.
2. Replace equipment delivered to job site that does not comply with above requirements at no expense to the Owner.

B. Storage and Protection:

1. Store products in covered storage area, protected from the elements, outside the general construction area until installed.
2. Handle items to avoid damage.
3. Replace damaged items with same item in new condition.

1.6 WARRANTY

- A. Provide warranty in accordance with Section 260000 - General Electrical Requirements.

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED SUPPORT SYSTEMS

A. Manufacturers:

1. Unistrut
2. Super-Strut
3. B-Line
4. K-Line
5. Erico.

- B. Material:
 - 1. Cold worked steel.
 - 2. Type 304 stainless steel: Use for PVC, liquid-tight flex, or plastic-coated conduit installed on wood construction in outdoor, damp, corrosive or marine environments.
- C. Finish:
 - 1. Heated indoor areas: Pre-galvanized zinc coating.
 - 2. Outdoor areas: Hot dipped galvanized finish. In addition, coat hot dipped galvanized finish channel field cuts with zinc rich paint provided by the support system manufacturer.
 - 3. Painted areas: Paintable galvanizing or phosphatized and primed.
 - 4. Surface metal raceways: U.L. Listed epoxy coating.
- D. Channel:
 - 1. Standard Size: 1-5/8 inch x 1-5/8 inch. Gauge thickness as required for attached load.
 - 2. Standard Hole Pattern: Slotted. Provide solid channel in exposed public areas.
- E. Nuts and Hardware:
 - 1. Channel nuts: Hardened steel (ASTM-A675 and ASTM A36).
 - 2. Bolts, screws and nuts: Hardened steel (ASTM-A307, ASTM A563 and SAE J429).
 - 3. Finish: Electroplated zinc.
- F. Fittings: Plate steel (ASTM A635). Epoxy or electroplated zinc coating.
- G. Electrical Accessories: Provide accessories from the support system manufacturer designed for the specific equipment to be supported to include but not limited to:
 - 1. Lighting fixture hangers.
 - 2. Outlet box adapters.
 - 3. Snap-in closures.
 - 4. Conduit connection plates.
 - 5. Junction box adapters.
 - 6. Strut joiners.
 - 7. "Caddy" fasteners are permitted for support of conduit to concealed metal studs and for conduit concealed above suspended acoustical ceilings.

2.2 SLEEVES, ACOUSTICAL SEALS AND FIRE-STOPPING

- A. See Part 3 - PENETRATIONS.
- B. Sleeves for pipes through fire rated and fire resistive floors and walls, and fire proofing: UL listed prefabricated fire rated sleeves and seals.

2.3 WALL/FLOOR PENETRATION WATER SEALS

- A. Mechanical seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the conduit and the wall opening.
- B. EPDM seals.
- C. 316 Stainless steel bolts and nuts.

- D. Hot-dipped galvanized or coated sleeve with full water stop flange with continuous weld on both sides.
- E. Manufacturer: Metraflex, Thunderline, Crouse-Hinds, or pre-approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installation, prepare detailed shop drawings of the planned installation of hanger and support products specified by this section. Coordinate the location, type and size of hangers and supports, housekeeping pads (thickness/perimeter overhang dimensions) and roof curbs with Architectural and Structural elements utilizing the shop drawing review process.
- B. Submit shop drawings required by this section coordinated with the seismic design and associated shop drawings required by Section 200548 – Mechanical Vibration and Seismic Control – Mechanical Vibration and Seismic Control as a single submittal.
- C. Do not install hangers and supports without approved shop drawings.

3.2 GENERAL INSTALLATION

- A. Install hangers and supports in accordance with manufacturer's instructions, applicable Code requirements (NFPA 70) and approved shop drawings.
- B. See Section 260000 – Electrical General Requirements for electrical equipment wall mounting heights.

3.3 VIBRATION AND SEISMIC CONTROL PRODUCT INSTALLATION

- A. Install vibration isolators, seismic control and wind restraint systems in strict compliance with the manufacturer's written instructions and certified and approved application engineering installation drawings and details in accordance with Section 20 0548 – Mechanical Vibration and Seismic Control.

3.4 INSERT AND ATTACHMENT INSTALLATION

- A. Inserts
 1. Provide inserts or cast-in-place channels for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 4. Use expansion type anchor bolts with pre-cast concrete including concrete masonry units within loading limits of the pre-cast material and anchor bolt manufacturer's recommendations.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
 6. Plastic screw inserts and caulked lead inserts are prohibited, except for mounting instructions and control diagrams.

- B. Attach electrical equipment to structure as follows:
1. Hollow masonry: Toggle bolts.
 2. Solid masonry and concrete: Preset inserts or expansion bolts.
 3. Structural steel: Beam clamps which engage both sides of structural member or have retaining clips or other approved means for positive engagement.
 4. Metal surfaces: Machine screws, bolts or welding.
 5. Wood construction: Wood or sheet metal screws. Bugle head drywall screws or deck screws are not allowed.
 6. Do not use powder actuated fasteners for anchorage in tension applications. Obtain written permission from the Owner prior to using any type of powder powered studs.
 7. Attachment to plaster or gypsum board (sheet rock) not approved. Equipment shall be attached to or supported from structure.

3.5 RACEWAY INSTALLATION

- A. Support raceways using approved types of wall brackets, ceiling trapeze hangers or malleable iron straps utilizing attachment methods described above. "Perforated plumber's strap" is not permitted as a means of support.
- B. Support raceways independent of ceiling systems, piping and ductwork. Exceptions: Lighting fixtures and outlet boxes (i.e. ceiling speaker boxes) specifically designed for attachment to suspended ceiling systems
- C. Support EMT conduit (1-1/2 inch and smaller/dry locations) using hanger rods with spring steel fasteners.
- D. Support cable trays and multi-conduit runs independently from other support systems utilizing double hanger rods at each support point.

3.6 LIGHTING INSTALLATION

- A. General
1. Attach safety hanger wires to lighting fixtures such that in event of a ceiling suspension system failure, no part of the fixture will drop more than 6 inches below normal ceiling height. Secure each end of each wire with a minimum of three tight wraps.
- B. Fixtures (greater than 20 pounds/non-suspended ceiling applications)
1. Support lighting fixtures from structural members capable of supporting the total weight of the fixture and independent from electrical wiring system. Attach to steel members using approved beam clamps and rods.
- C. Fixtures (suspended ceiling system applications)
1. Positively attach lighting fixtures to suspended ceiling grid for 100 percent of fixture weight acting in any direction using positive clamping devices that fully surround the supporting member (i.e. Caddy "IDS" or equal).
 2. Provide supplemental safety hanger wires as follows:
 - a. Fixtures (weighting less than 56 pounds): Provide two 12 gauge wires or equivalent chains connected from the diagonal corners of the light fixture housing to the structure above. These wires may be slack.

- b. Fixtures (weighting greater than 56 pounds): Provide full direct support from the structure above. Attach wires from within 3 inches of each corner of the fixture.
- c. Pendant-hung lighting fixtures
 - 1). For each fixture, provide direct support from the structure above using a minimum of two 12 gauge wires, equivalent aircraft cable or an approved alternate support system without using the ceiling suspension system for direct support. Securely attach wire/cable to fixture, route through fixture stem and securely attached to structure.
 - 2). Provide loop and hook or swivel hanger assemblies fitted with a restraining device to secure stem in the support position during earthquake motion.
 - 3). Support fluorescent fixtures with flexible hanger device at the attachment point to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.

3.7 PENETRATIONS

- A. Coordinate electrical penetrations with architectural, structural and mechanical construction details prior to installation. Set sleeves in position in concrete formwork. Provide reinforcement around sleeves as required.
- B. Provide compatible materials, fasteners, adhesives, sealants, and other products required for proper installation.
- C. Penetrations through roof, exterior walls and floors shall be weather and water tight (see floor penetration seals).
- D. Firestopping: Provide UL rated firestopping assemblies for rated roof, wall and floor penetrations in accordance with Division 7.
- E. Conduit Sleeves
 - 1. Provide sleeves for conduit passing through floors, walls, ceilings, or roofs.
 - a. Fabricate sleeves in non-load bearing walls from 20 gauge galvanized sheet steel conforming to ASTM A 924/A 924M.
 - b. Fabricate sleeves in load bearing walls from standard weight galvanized steel pipe conforming to ASTM A 53/A 53M.
 - c. Provide 1/2 inch clearance between conduit and sleeve opening.
 - 2. Provide escutcheons for conduit passing through walls, floors and ceilings in finished areas, below counters and inside closets and casework subject to view when doors are open. Size escutcheons to cover sleeves. Secure escutcheons in position.
- F. Acoustical Seals
 - 1. Monolithic sound walls (i.e. poured concrete or masonry): Provide wall sleeve with approximately one-inch annular space around conduit. Pack annular space with backer rod or acoustical filler as specified in Division 7. Allow a 1 inch recess at each end of sleeve. Caulk sleeve flush with flexible sealant or fire-stopping material as specified in Division 7.
 - 2. Where acoustical wall is a two component type, such as a staggered or double stud partition, treat each component as a separate wall. Pack and seal each half of penetration sleeve as previously specified, except that only the exposed end of each sleeve portion

shall be caulked with sealant or firestop. Provide adequate separation between each sleeve.

G. Wall Penetration Seals

1. Provide pre-engineered wall penetration water seal systems for exterior wall penetrations.
2. Select appropriate wall penetration sealing systems based on conduit material and nominal conduit size in accordance with the manufacturer's selection charts.
3. Install conduit and sealing system prior to waterproofing the wall. Grout void between water seal and outside face of foundation wall to provide continuous bearing surface for waterproofing fabric.

H. Floor Penetration Seals

1. Provide pre-engineered floor penetration water seal systems for conduit floor penetrations in rooms where a pipe leak/failure could result in water damage to adjacent spaces (i.e. mechanical rooms located above the ground floor or basement) and other areas as noted.
2. Extend conduit floor penetration sleeves 2 inches above finished floor.

3.8 FIELD QUALITY CONTROL

- A. Document each installation and operational step utilizing the approved PC/FT checklists in accordance with Section 019100 - Commissioning.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes specific requirements, products, and methods of execution relating to conduit, conduit fittings, surface raceways, multi-outlet assemblies, wireways, outlet boxes, pull boxes and junction boxes approved for use on this project. Type, size and installation methods shall be as shown on Drawings, required by Code and/or specified in this Section.
- B. Related Sections
 - 1. 260519 - Low Voltage Electrical Power Conductors and Cables
 - 2. 260526 - Grounding and Bonding for Electrical Systems
 - 3. 260529 - Hangers and Supports for Electrical Systems

1.2 REFERENCES

- A. American National Standards Institute/Underwriters Laboratory
 - 1. ANSI C80.1 – Electrical Rigid Steel Conduit
 - 2. ANSI C80.3 – Steel Electrical Metallic Tubing
 - 3. ANSI C80.5 – Electrical Rigid Aluminum Conduit
 - 4. ANSI C80.6 – Electrical Intermediate Metal Conduit
 - 5. ANSI/UL 1 – Flexible Metal Conduit
 - 6. ANSI/UL 6 – Electrical Rigid Metal Conduit – Steel
 - 7. UL 6A – Standard for Electrical Rigid Metal Conduit – Aluminum and Stainless Steel
 - 8. UL 360 – Standard for Liquid Tight Flexible Steel Conduit
 - 9. UL 514A – Metallic Outlet Boxes
 - 10. UL 514B – Conduit, Tubing and Cable Fittings
 - 11. UL 651 – Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
 - 12. UL 651A – Type EB and A Rigid PVC Conduit and HDPE Conduit
 - 13. ANSI/UL 651B – Standard for Continuous Length HDPE Conduit
 - 14. ANSI/UL 797 – Electrical Metallic Tubing – Steel
 - 15. ANSI/UL 1242 – Electrical Metal Intermediate Conduit – Steel
- B. National Electrical Manufacturers Association
 - 1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
 - 2. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
 - 3. NEMA OS 1 – Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 4. NEMA RN 1 – Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
 - 5. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit
 - 6. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
 - 7. NEMA WD 6 - Wiring Device Configurations.
- C. NECA (National Electrical Contractors Association) Standard of Installation.

1.3 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.
- B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, surface raceway finishes (custom factory pre-painting, color as selected by architect), and accessories.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 QUALITY ASSURANCE

- A. Raceways and boxes shall be standard types and sizes as manufactured by a nationally recognized manufacturer of this type of materials and be in conformity with applicable standards and UL listings.
- B. Surface raceways shall be of the latest approved design as manufactured by a nationally recognized manufacturer and shall be listed by the Underwriters' Laboratory and bear the UL label.
- C. Pull and junction boxes 50 cubic inches and smaller shall conform to specifications for outlet boxes.
- D. Pull and junction boxes larger than 50 cubic inches shall conform to U.L. Standard 50, Cabinets and Boxes.
- E. Perform Work in accordance with NECA Standard of Installation.
- F. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Conduit types specifically approved for use on this project shall be of the following types only:
 - 1. Galvanized rigid metal conduit - GRC or RMC.
 - 2. Intermediate metal conduit - IMC.
 - 3. Rigid copper-free aluminum conduit.
 - 4. Electrical metallic tubing - EMT.
 - 5. Polyvinyl chloride conduit - PVC: May be Schedule 40 or Schedule 80, except where Schedule 80 is specifically noted or specified.
 - 6. Flexible metal (steel) conduit - FMC or flex: In short lengths as specifically permitted.
 - 7. Liquid-tight flexible steel conduit - LFMC: In short lengths as specifically permitted.
 - 8. Extreme temperature liquid-tight flexible steel conduit - AT: Shall have temperature rating of -67 ° F to +220 ° F, Liqueatite "ATLA", or as approved.

9. MC Cable, as specifically allowed in Section 260519 - Low Voltage Electrical Power Conductors and Cables
10. Types specifically identified on the Drawings or in the Specifications
11. Other products not specifically approved such as ENT, MC Cable, etc., are not allowed.
12. Manufactured wiring systems are not approved.

2.2 FIRE ALARM CONDUIT

- A. EMT conduit utilized for fire alarm system wiring shall be factory pre-painted with a bright red topcoat, Allied Fire Alarm Red or as approved. Other conduit types utilized for fire alarm system wiring shall be identified with red paint or red tape wrapped a minimum of 4 times around the conduit every 10 feet and at each fire alarm system junction box.

2.3 CONDUIT FITTINGS

- A. Fittings utilized with rigid steel, IMC, and aluminum shall be galvanized steel or iron or copper-free aluminum and shall be threaded. Conduit bushings shall be provided and shall be of the insulated types. Where grounding bushings are required, provide insulated grounding bushings with integral pressure type ground lugs, Thomas & Betts "Blackjack", or as approved.
- B. Couplings and connectors for EMT shall be made of steel or malleable iron. Die-cast products shall not be used. Connectors shall have insulated throats. Connectors and couplings shall be setscrew or compression type.
- C. Fittings for flexible metal conduit shall be steel or malleable iron only. Throats shall be insulated.
- D. Fittings for liquid-tight flexible conduit shall be steel or malleable iron, of a type incorporating a threaded grounding cone, nylon or plastic compression ring, and a tightening gland, providing a low resistance ground connection. Throats shall be insulated.

2.4 SURFACE METAL RACEWAY

- A. The Basis of Design is equipment from Wiremold, Hubbell or Mono-Systems, to set a standard for quality and style.
- B. Large multi-circuit raceways shall be aluminum channel 5 inches wide by 2 inches deep, with separation for low voltage channel, and fitted cover, suitable for use as surface metal raceway, Wiremold Series 5200 or as approved.
- C. Small surface metal raceway for individual circuit runs shall be one piece surface metal raceway of the appropriate dimensions for the conductors, Wiremold Series 500/700, or as approved.
- D. Finish: Large raceways shall be aluminum. Small raceways shall be furnished with factory ivory color finish and field painted to match adjacent surfaces, unless otherwise noted on the Drawings.
- E. Large raceways shall have factory pre-punched base channel mounting fastener holes. Provide suitable backing for mounting attachment, hollow wall anchors shall not be used.
- F. Provide manufacturer's standard Fittings, Boxes, and Extension Rings:
 1. Wall box connectors shall be concealed entry type.

- G. Uses Permitted
 - 1. Surface metal raceway shall only be used where specifically shown on the Drawings.

2.5 CAST BOXES

- A. Cast boxes with threaded hubs, external mounting brackets or holes, and gasketed covers shall be used in the following locations:
 - 1. Exterior locations.
 - 2. Wet or damp locations.
 - 3. Mechanical rooms, pump stations, etc., where exposed to mechanical damage.
 - 4. Exposed interior locations below 48 inch above floor where subject to damage.
 - 5. Where shown on Drawings.

2.6 STEEL BOXES

- A. Galvanized pressed steel boxes may be used wherever they are permitted by code, except in areas indicated in the preceding paragraph.
- B. Flush mounted, pressed steel boxes shall be equipped with external mounting brackets for attachment to framing members with screws or nails.
- C. Ceiling boxes and wall boxes for bracket lights shall be not less than 4 inch in diameter by 1 ¼ inch deep and shall have 3/8 inch malleable iron fixture studs if required.
- D. Grounding Screw: All stamped steel boxes shall have a drilled and tapped hole in the back of the box for a grounding screw.
- E. Accessories: Box covers, extension rings, bases, hanger bars, etc., for use in connection with the installation, shall be approved for use in the various applications.

2.7 TELECOMMUNICATION OUTLET BOXES

- A. Boxes for telecommunication outlets shall be a minimum of 4 inches square by 2 1/8 inches deep.
- B. Device rings for telecommunication outlets shall be single-gang, minimum 5/8 inches deep, to provide a minimum internal finished depth of 2 3/4 inches.

2.8 INDOOR PULL AND JUNCTION BOXES

- A. Indoor pull and junction boxes shall conform to Article 314 of the NEC and the following requirements:
 - 1. Sheet metal boxes are approved for use in all dry, interior, nonhazardous locations.
 - 2. Boxes installed in wet locations shall be NEMA 3R, unless otherwise noted.
 - 3. Furnish such boxes, whether shown or not, in order to conform to requirements for maximum pulling length and maximum number of bends allowed.
 - 4. Special boxes, as noted on the Drawings, shall be installed in areas of specific service and/or hazards.
- B. Junction box extension rings will not be accepted on new boxes. Appropriate size boxes shall be used for each application.

2.9 TELECOMMUNICATION SYSTEM PULL BOXES

- A. Telecommunication system Pull Boxes shall also conform to ANSI/EIA/TIA 569-A and the BICSI Telecommunications Distribution Methods (TDM) Manual.
- B. Dimensions:
1. Pull boxes for straight through pulls shall have minimum interior dimensions in accordance with the following Table:

Maximum Trade Size Conduit	Size of Box			For Each Additional Conduit Increase Width
	Width (inches)	Length (inches)	Depth (inches)	
1 Inch	4	16	3	2 inches
1 1/4 Inch	6	20	3	3 inches
1 1/2 Inch	8	27	4	4 inches
2 Inch	8	36	4	5 inches
2 1/2 Inch	10	42	5	6 inches
3 Inch	12	48	5	6 inches
3 1/2 Inch	12	54	6	6 inches
4 Inch	15	60	8	8 inches

2.10 TELECOMMUNICATION SYSTEM SPLICE BOXES

- A. Unless otherwise specified or noted on the Drawings, splice boxes shall not be used in interior horizontal pathway conduits or interior backbone pathway conduits.
- B. Where required in a building service entrance or campus backbone pathway system, splice boxes shall be provided in accordance with the requirements of ANSI/EIA/TIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces and the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual.

PART 3 - EXECUTION

3.1 CONDUIT USES PERMITTED

- A. Conduits shall be of the sizes shown on the Drawings or as required by the NEC, whichever is larger. Base sizes on using type XHHW for wire sizes #6 and smaller and type THHN/THWN wire for wire sizes #4 and larger. Unless otherwise noted, conduits installed in the following locations shall be of the types specifically identified only:
1. Outdoors aboveground or damp locations - RMC, IMC or extreme temperature liquid-tight flexible steel conduit (where required).
 2. Dry indoor locations, concealed or exposed - RMC, rigid aluminum, EMT (where not susceptible to physical damage), flexible conduit where necessary, or IMC.
 3. Indoor locations, exposed, where susceptible to physical damage - RMC or IMC.
 4. Motor and equipment flexible connections - LFMC or FMC (when installed in plenum spaces).

3.2 RACEWAY INSTALLATION METHODS - GENERAL

- A. Concealed raceways: In occupied areas, conduit and raceways shall be concealed unless specifically noted otherwise. In service spaces (mechanical equipment rooms, electrical rooms, storage closets, etc.), approved raceways may be surface-mounted for connection to equipment in exposed surface mounted locations and in exterior locations as noted on the Drawings.
- B. Concealed raceways shall be routed as directly as possible with a minimum of bends. Concealed raceways above lay-in ceilings shall be installed a minimum of 12 inches above the ceiling grid.
- C. Exposed Raceways: Where allowed by this Specification or specifically noted on the Drawings, raceways may be mounted on the surface of walls, ceilings and other surfaces. Exposed raceways shall comply with the following:
 - 1. Exposed raceways shall be run parallel or perpendicular to building lines and bent symmetrically or made up with standard elbows or fittings.
 - 2. Surface-mounted conduit, junction boxes, pull boxes, outlet boxes, etc. installed in finished areas shall be painted to match the surrounding surfaces.
 - 3. Connectors and fittings for raceways and conduits installed on the surface in exterior locations shall be suitable for and Listed for use in a wet location.
 - 4. Conduits installed in exterior locations shall be painted to match the exterior finish of the building surface to which they are attached. This shall include conduits attached via racks and stand-off brackets, or attached directly to the surface.
- D. There shall not be more than the equivalent of four quarter bends (360 degrees total) between pull points. Pull boxes added to conduit runs as a result of this requirement shall be in accordance with this Section.
- E. Conduit and tubing shall be cut square and reamed smooth at the ends and all joints made tight. Conduit threads shall be lubricated with an approved thread lubricant.
- F. Raceway for power wiring shall not be installed in the floor slab beneath telecommunication rooms.
- G. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box or outlet box by means of a locknut on the outside and a locknut/bushing on the inside, or by means of a liquid-tight, threaded, self-locking, cold-weld type wedge adapter. Connections shall be made wrench tight. Locknuts shall be the bonding type with sharp edges and shall be installed in a manner that will assure a locking installation. Locknuts and bushings or self-locking adapters will not be required where conduits are screwed into threaded connections. Conduit runs shall be protected from the entrance of foreign material prior to the installation of conductors.
- H. Conduit or tubing deformed or crushed in any way shall not be installed. Conduit shall be bent only with approved bender (hydraulic or hickey). Bending machines shall be used to make field bends in conduit of 1-1/4 inch size and larger. Torches shall not be used in making conduit bends.
- I. Raceways shall be spaced at least 6 inches from parallel runs of heating system pipes, flues, other high temperature piping systems, and other heat sources. This basic spacing shall be increased if necessary to ensure that raceways experience no significant temperature rise from external sources. Raceways shall not be embedded in any spray applied insulation, fireproofing, or other materials that would restrict heat dissipation.

- J. Raceways for Audio/Video systems shall be spaced a minimum of 24 inches from parallel runs of conduits and wiring of power, lighting, and Class 1 signaling. Maintain at least 48 inches of separation from dimmed lighting circuits. Where runs are run parallel for less than 50 feet the required spacing may be halved (12 inches, or 24 inches from dimmed lighting circuits). Where runs are adjacent for less than 6 feet, or where conduits cross at right angles, separations of 2 inches may be used.
- K. Pull wires shall be provided in spare and unused conduits. (Nylon "jet-line" or as approved.)
- L. Conduits stubbed up out of floor and terminating inside of an enclosure shall have insulating grounding bushings installed.
- M. Raceways penetrating vapor barriers or traversing from warm to cold areas shall be sealed on the inside with a non-hardening duct sealing compound to prevent the accumulation of moisture, and shall be taped airtight to the vapor barrier on the outside. Refer to Section 260000 for additional requirements and limitations regarding penetration of vapor barriers.
- N. Raceways (particularly PVC) shall be provided with expansion joints where necessary to allow for thermal expansion and contraction. Set initial opening of expansion joints per manufacturer's instructions, to suit the ambient temperature at the time of installation.
- O. Provide flexible conduit connection at seismic joints to allow for displacement of conduit in all three axes. Provide appropriate lengths of flexible conduits at seismic joints and appropriate amounts of slack in conduit to allow movement of conduit/cablings in accordance with the design of the seismic joint. Slack shall be maintained in conduit after cabling is installed. Minimum lengths of flexible conduit and minimum amount of slack for various size conduits shall be as follows:
 - 1. 2 inch and greater: 4 foot length, 4-6 inches slack.
 - 2. 1-1/2 inch and smaller: 2 foot length, 3 inches slack.
- P. Flexible metal conduit with supplemental ground jumper shall be used for connection to vibrating equipment, or where installation conditions warrant its use with express permission. Flexible conduit shall not penetrate walls. Liquid-tight flexible conduit with supplemental ground jumper shall be used for motor and transformer connections (except utilize flexible metal conduit in plenum spaces). The ground jumper in flexible conduits shall be routed within the conduit.
- Q. Length of flexible conduit shall not exceed 36 inches, except for lighting fixture whips and where specifically noted. Fixture whips shall not exceed 72 inches. Flexible conduit shall not penetrate walls or vapor barrier retarder/barrier.
- R. Electrical raceways may penetrate roofing membranes only where absolutely necessary. Submit intended locations to Contracting Agency for approval prior to installation. Such penetrations shall be flashed and sealed as required for mechanical piping penetrations of roof. Where practical, conduits stubbed up to roof mounted equipment shall be routed within the equipment curb supporting the equipment.

3.3 RACEWAY INSTALLATION METHODS – TELECOMMUNICATIONS SYSTEMS

- A. Installation methods for telecommunication system conduits shall comply with Installation Methods – General, above, unless superseded by more stringent requirements of this section.

- B. Telecommunications conduits shall comply with the requirements of TIA/EIA-569-A and the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual. Note that some of these requirements are more stringent than the requirements of the National Electrical Code.
- C. There shall be no more than two 90-degree bends between pull points in telecommunications conduit. Pull boxes added to conduit runs as a result of this requirement shall be in accordance with this Section. If it is not practical to install a pull box in the run due to field conditions, the conduit size shall be increased to the next trade size for each additional 90-degree bend. Offsets shall be considered as equivalent to a 90-degree bend.
- D. Inside radius of conduit bends shall be at least 6 times the internal diameter of the conduit for sizes up to 2 inch trade size; 10 times the internal diameter of the conduit for sizes larger than 2 inch trade size. Where bending machine shoes are not available with the required bending radius for a one-shot field bend, factory bent, large radius 90-degree elbows shall be provided.
- E. Conduits stubbed to cable trays shall be terminated within a maximum horizontal distance of 4 inches from the tray and in a vertical zone between 1 to 6 inches above tray. Conduits shall be supported from structure within a maximum horizontal distance of 12 inches from the tray. Conduits shall be provided with a grounding bushing and shall be bonded to the cable tray with a minimum 12 AWG copper conductor.
- F. Use of flexible conduit for telecommunications shall be kept to a minimum and shall be at the discretion of the Contracting Agency. Obtain prior written approval for the use of flexible conduit. Where required due to physical considerations, flexible metal conduit may be allowed in lengths not exceeding 4 feet. If used, flexible metal conduit shall be increased by one trade size for the application used (see Conduit Sizes).
- G. Conduits entering the telecommunications room or equipment room through the floor shall be terminated 4 inches above finished floor. Conduits entering the telecommunications room or equipment room from above shall be terminated 4 inches below the finished ceiling, but in no case shall the conduits terminate more than 12 inches above the cable pathway support or distribution frame.
- H. Conduit sleeves connecting vertically “stacked” telecommunications rooms shall be terminated 4 inches above finished floor. Conduits and cutout openings between floors shall be sealed with firestopping material that is reusable, to accommodate additions and deletions, moves and changes in the cabling system.
- I. Layout of conduits shall give consideration to nearby sources of electromagnetic energy such as electrical power wiring, large electric motors and generators, induction heaters, arc welders, variable frequency drives, etc. Maintain the greatest separation practicable between telecommunication raceways and sources of electromagnetic interference (EMI). A minimum of 5 inches of separation shall be maintained between telecommunication raceways and fluorescent lighting ballasts.
- J. Pull wires shall be provided in spare and unused conduits. (Nylon “jet-line” or as approved.)

- K. Maintain minimum separation from $\leq 480V$ power wiring in accordance with the following table:

Condition	Minimum Separation Distance		
	< 2 kVA	2-5 kVA	> 5 kVA
Unshielded power lines or electrical equipment in proximity to open non-metal telecommunications pathways	5 inches	12 inches	24 inches
Unshielded power lines or electrical equipment in proximity to a grounded metal telecommunications conduit pathway	2.5 inches	6 inches	12 inches
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal telecommunications conduit pathway	--	3 inches	6 inches

3.4 CONDUIT SIZES – GENERAL

- A. Minimum sizes for rigid steel, IMC, FRE, rigid aluminum and PVC-40 conduits shall be $\frac{3}{4}$ inch.
- B. Minimum size for EMT shall be $\frac{1}{2}$ inch.
- C. Minimum size for flexible conduits shall be $\frac{1}{2}$ inch , except fixture whips may be $\frac{3}{8}$ inch as allowed by the NEC.

3.5 CONDUIT SIZES – TELECOMMUNICATIONS SYSTEMS

- A. Minimum size for conduit runs to outlets is 1 inch.
- B. Unless indicated otherwise, individual conduit homeruns shall serve no more than one telecommunications outlet.

3.6 STRUCTURAL COORDINATION

- A. Layout conduits in slabs to avoid compromising structural integrity. Obtain approval from Structural Engineer for maximum conduit sizes, quantities, arrangement, and placement in structural slabs.
- B. Structural members shall not be cut, drilled, or notched for raceways or other electrical features unless specifically accepted by the Contracting Agency.
- C. X-ray concrete prior to core drilling. Do not cut rebar without specific authorization from the Contracting Agency. Protect existing equipment and building finishes prior to performing core drills. Replace or repair equipment and/or building finishes damaged during core drilling operations as directed by the Contracting Agency.

3.7 SURFACE RACEWAY INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Use flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- C. Provide outlets in locations shown or according to spacing specified on the Drawings. Where spacing is specified, the maximum distance from each end of the raceway to the first outlet shall not exceed one-half of the specified spacing distance. Mounting elevations shall be as noted on the Drawings or as shown on the Architectural Elevations. If a conflict exists, the elevation shown on the Architectural Elevations shall take precedence.
- D. Provide field paint touch-up with factory furnished paint to match factory pre-painted finish, for all chips, scraps, scratches, fittings and unpainted sections of the surface raceways and multi-outlet assemblies, after installation of all devices and covers are complete.
- E. Provide appropriate separate device finish plates for outlets and telecommunication jacks as specified in other Sections.
- F. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- G. Close ends of wireway and unused conduit openings.
- H. Ground and bond raceways, multi-outlet assemblies and wireways under provisions of Section 260526 – Grounding and Bonding for Electrical Systems.

3.8 OUTLET BOX INSTALLATION

- A. Outlet boxes shall be securely fastened in position and supported independently of the conduit system.
- B. Outlet boxes located in suspended ceiling system shall be fastened to ceiling "t-bar" system with bar-hanger rods manufactured for the purpose, or from hanger rods with solid supports from structure above. "T-bar" hanger rods shall be clipped to cross-members supported by the main ceiling support members. Outlet boxes supported from the suspended ceiling system shall be provided with one safety wire attached to the box or box support clip, or two safety wires attached to the bar hanger.
- C. Boxes shall be installed true to the building lines and at equal heights in conformity with mounting heights specified in other sections of the specification.
- D. Provide the best suitable box for each outlet requirement. Extension rings shall not be used on new construction except where needed to bring an outlet box out to 1/8 inch of the finished wall or ceiling line.
- E. Boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have lugs or ears to secure covers.

- F. Boxes shall be rigidly secured in position. Recessed boxes shall be so set that the front edge of the box shall be flush with the finished wall or ceiling line, or not more than 1/8 inch back of same. This requirement is more stringent than NEC requirements.
- G. Boxes shall be accessible.
- H. Provide boxes for each application that will not violate the fire rating of the wall, floor or ceiling assembly in which the box is installed.
- I. Do not place order for floor boxes without ensuring that the Contracting Agency has positively approved submittals for the specific cover types/styles colors necessary for all applications and locations.
- J. Recessed boxes shall not be placed back-to-back in adjacent rooms. They shall be offset at least 12 inches, or greater as required by codes and standards applicable to the specific construction.
- K. Boxes (electrical boxes, outlet boxes and telecommunication boxes, etc) penetrating fire rated walls, walls with vapor retarder/barriers, wall types that extend to structure or wall types that contain batts shall be sealed airtight with approved Firestop Putty Pads to reduce sound transmission, reduce air transmission and increase fire resistance. Mold putty pads around electrical junction boxes and conduits to form an airtight seal in accordance with manufacturer's installation instructions.

3.9 JUNCTION BOX AND PULL BOX INSTALLATION

- A. Junction and pull boxes shall be installed so that covers are readily accessible and adequate working clearance is maintained after completion of the installation.
- B. Select boxes properly sized per NEC for power and lighting applications.

3.10 TELECOMMUNICATIONS SYSTEM PULL BOXES

- A. Where a pull box is required in a 1 inch conduit run, outlet boxes as specified in this Section may be used. Where a pull box is required in a conduit run 1 1/4 inch or larger, or where required for multiple raceways, the box shall be sized in accordance with the Table in this Section.
- B. Pull boxes shall be located in straight-through sections of horizontal cabling pathways (conduits). Pull boxes shall not be used for angle pulls or to accomplish changes in direction of the pathway.
- C. Multiple raceways connecting to telecommunications system pull boxes shall penetrate box walls such that they are distributed evenly along the Box wall.

3.11 TELECOMMUNICATIONS SYSTEM JUNCTION BOXES

- A. Telecommunications system interior pathways shall not contain junction boxes.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Provide identification of on equipment, raceways, boxes and conductors.
- B. Section includes:
 - 1. Nameplates
 - 2. Labels
 - 3. Wire markers
 - 4. Conduit markers
 - 5. Miscellaneous Electrical Identification
- C. Related Sections: Divisions 26, 27 and 28 Sections.

1.2 SUBMITTALS

- A. Division 1 and Section 260000 – Electrical General Requirements.
- B. Product Data:
 - 1. Submit manufacturer’s catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Electrical Distribution Equipment Labels and Nameplates
 - 1. Name equipment in accordance with Contract Documents.
 - 2. Nameplates shall be laminated plastic, 0.125 inch thick, with matte finish and square corners. Minimum lettering size as noted elsewhere in this section.
 - a. Label and Nameplate Colors:
 - 1). Normal Equipment: White letters on a black background.
 - 2). Emergency Equipment: White letters on a red background.
 - 3). Standby Equipment: Black letters on a yellow background.
 - b. Securely attach labels with threaded fasteners or pop-rivets. Adhesive attachment not acceptable.
 - c. Temporary markings not permitted on equipment. Repaint trims, housings, etc., where markings cannot be readily removed. Refinish defaced finishes.
 - 3. Include item designation and branch circuit designation (panel and circuit number) on disconnects, starters, equipment and device nameplates, e.g., “FAN No. 4, Circuit LA-30”).

2.2 WIRE AND CABLE MARKERS

- A. Wire and Cable Markers: Wrap on labels, cloth tape type wire markers or tubing type for all phase, neutral and ground conductors.

2.3 LABELS

- A. Adhesive film label with clear protective overlay: Machine printed, in black, by thermal transfer process or equivalent. Minimum lettering size as noted elsewhere in this section. Overlay shall provide a weatherproof and UV resistant seal for label.

2.4 POWER ONE-LINE DIAGRAM

- A. Laminated, approved print of the "As-Built" power distribution system. Install in accordance with Part 3.

PART 3 - EXECUTION

3.1 NAMEPLATE INSTALLATION

- A. Install nameplate parallel to equipment lines.
- B. Mechanically fasten nameplates using threaded fasteners or pop rivets.
- C. Mechanical fasteners shall have no sharp edges or points which can damage conductors or injure personnel.
- D. Temporary markings are not permitted on equipment. Repaint trims, housings, etc., where markings cannot be readily removed. Refinish defaced finishes.
- E. No labeling abbreviations are permitted without prior approval.

3.2 DISTRIBUTION AND BRANCH PANELBOARD NAMEPLATES

- A. Nameplate shall contain the following information (minimum ½ inch height letters):
1. Line 1: Panel Name as noted on drawings and schedules.
 2. Line 2: Voltage and Phase.
 3. Line 3: Shall indicate if panelboard is "NORMAL" (black background), or "STANDBY" (yellow background) or "EMERGENCY" (red background).
 4. Line 4: Source from which panel is fed, "FED FROM: PANEL NH-031".
- B. Install a 2 inch x 4 inch nameplate on each branch panelboard where a building contains distribution systems of different voltages (minimum 1/8 inch height letters):

THIS BUILDING CONTAINS TWO WIRING SYSTEMS:

	<u>Phase A</u>	<u>Phase B</u>	<u>Phase C</u>	<u>Neutral</u>
480Y/277V	Brown	Orange	Yellow	Gray
208Y/120V	Black	Red	Blue	White

3.3 NAMEPLATE LOCATIONS

- A. Provide 1/4-inch minimum height letters on:
1. Panelboards: Provide signage in accordance with NEC 408 indicating maximum available fault current and date of fault current calculation.

2. Disconnects, starters, VFDs and contactors:
 - a. Line 1: Load Served (Use nameplate designation for source).
 - b. Line 2: Panelboard and circuit number from which the device is fed.
 - c. Line 3: Voltage, Phase, fuse size or circuit breaker size.
3. Lighting control relays, dimmer controls and remote lighting control equipment.
4. Switches and receptacles where item controlled is not visible from the switch, or as noted on Drawings.
5. External Power Sources: Provide 1/4 inch white letters on red background on all starters or controllers that receive power from an external source that is not de-energized by operating the associated disconnecting means.
6. Designated electrical equipment.

3.4 RECEPTACLE AND LIGHT SWITCH DEVICE PLATES

- A. Provide 3/16 inch minimum height letters on receptacle and light switch device plates:
 1. Engrave branch circuit designation (panel and circuit number) on receptacle and light switch device plates, e.g., "NHA-30"). Verify final panel designations with Contracting Agency prior to engraving nameplates.

3.5 TELECOMMUNICATION LABELING REQUIREMENTS.

- A. Provide machine printed labels for all telecommunication racks, cabinets, patch panels, cables, outlets, etc., in accordance with ANSI/TIA/EIA-606-B to match existing building standards. Provide labeling nomenclature in accordance with information on the Drawings or Owner's labeling conventions. Submit labeling samples for all required applications.
- B. Machine Printed Label Requirements:
 1. PC Compatible.
 2. Can save and modify files.
 3. Fully integrated with AutoCAD.
 4. Editable Fonts and Sizes.
 5. Rotate Text and Objects.
 6. Vary Line Spacing.
 7. Ability to import graphical images.
 8. Capable for customization of layout.
 9. Re-positional labels.
- C. Labeling and color coding identification for this project shall conform to TIA/EIA-606-B.

3.6 LABEL LOCATIONS

- A. Provide 3/16 inch minimum height letters on the following equipment:
 1. Security System Device Labels:
 - a. Provide label on each security field device, denoting device address. Affix label to device faceplate for ceiling-mounted devices or wall mounted devices above 8'-0" AFF. Affix label inside back box for exterior devices.
 2. Fire Alarm Device Labels:
 - a. Provide label on exterior surface of each initiating device denoting the unique device address corresponding to the text annunciator description. For detectors, the label shall be affixed to the base and not to the detector itself. For pull stations, the label shall be affixed to the top of the device and not to the vandal proof cover.

- b. Provide label on each remote test station indicating description and location of device being tested.
- c. Provide label on telecom conductors at each end denoting FACP lines for use with the digital alarm communicator transmitter (DACT).

3.7 DISTRIBUTION/BRANCH CIRCUIT PANELBOARD CIRCUIT LABELING

- A. Distribution Panels and Branch Circuit Panelboard Directories: Provide neatly typed schedule (odd numbered circuits on left side or top, even on right side or bottom) under plastic jacket or protective cover to protect the schedule from damage or dirt. Securely mount on inside face of panelboard door. Define briefly, but accurately, nature of connected load (i.e., Lighting Room 201, Receptacles Janitor Room 155, Etc.) as approved. Sequentially numbered schedules shall not be used.
- B. Use final approved room numbers from finished construction (not necessarily as indicated on the drawings).
- C. Provide numbering for terminals on terminal strips in the terminal enclosure that identifies the origin, function and destination of each conductor.
- D. Install wire marker for each conductor inside panelboards (phase, neutral and ground conductors). Locate label within 6 inches of termination. Labels shall be visible with panel dead front installed.
- E. Provide updated circuit directory in existing panelboards that are modified. Install directory in panelboard in protective cover and submit electronically in the O&M Manual.

3.8 EMERGENCY SYSTEM IDENTIFICATION

- A. Emergency circuits shall be permanently marked so they will be readily identified as a component of an emergency circuit or system by the following methods:
 1. All equipment, boxes and enclosures (including transfer switches, generators and power panels) for emergency circuits shall be permanently marked as a component of an emergency circuit or system.
 2. Where boxes or enclosures are not encountered, exposed cable or raceway shall be permanently marked to be identified as a component of an emergency circuit or system at intervals not to exceed 25 feet.
 3. Receptacles supplied from the emergency system shall have a distinctive color (red) and circuit identification on the receptacle cover plate as noted elsewhere in these specifications.

3.9 WIRE MARKER INSTALLATION

- A. Install wire marker for each conductor (phase, neutral and ground conductors) at panelboards, pull boxes, outlet and junction boxes, and each load connection. Locate label within 6 inches of termination in panelboards. Labels shall be visible with panel dead front installed.
- B. Wire markers are not required on conductors in a pull or junction box that contains only an individual branch circuit, however, source panel and circuit number shall be noted on pull or junction box cover as noted elsewhere in this section.

- C. Fire Alarm Circuits: Provide cable markers showing Notification Appliance Circuit (NAC) or Signaling Line Circuit (SLC) loop identification number at fire alarm junction boxes and pullboxes.
- D. Security System Cables: Install wire marker for each cable at cabinets, pull boxes, junction boxes, and each load connection. Wire ID number shall be as shown on security system shop drawings.
- E. Power Circuits: Panelboard name and branch circuit or feeder number.
- F. Control Circuits: Control wire number as indicated on schematic and/or shop drawings.
- G. Color Code:
 - 1. Color code phases, neutral, and ground per NEC requirements and Section 260519 – Wire and Cable.
 - 2. Color code all low voltage system wiring in accordance with applicable Sections.

3.10 MISCELLANEOUS ELECTRICAL IDENTIFICATION

- A. Junction Boxes: Mark the circuit number(s) and panel source of wiring on all junction boxes with sheet steel covers. Mark with indelible black marker. On exposed junction boxes in finished areas mark on inside of cover.
- B. Conduits
 - 1. Mark all conduits entering or leaving panelboards with indelible black magic marker with the circuit numbers of the circuits contained inside.
 - 2. Fire Alarm System: Paint fire alarm conduits with a 6 inch band 10 feet on center with red paint where installed in concealed accessible location (or provide red conduit in accordance with Section 260519 – Low Voltage Electrical Power Conductors and Cables and Section 260533 – Raceways and Boxes for Electrical Systems. Where raceway is installed in exposed locations it shall be painted to match the adjacent surface.
 - 3. Empty Conduits: Provide tags with typed description of purpose, and location of opposite end, wired to each end of conduits.
- C. Junction Boxes
 - 1. Markings shall be made with indelible black marker.
 - 2. On exposed junction boxes in finished areas markings shall be on inside of cover.
 - 3. Mark the circuit numbers of wiring on all junction boxes with sheet steel covers.
 - 4. Mark all Special System junction boxes with sheet steel covers with appropriate system designation, e.g., "Intercom", "Clock", "Telecom", "Video Surveillance", etc. Fire Alarm System: Paint all fire alarm junction boxes inside and out with red paint where installed in concealed accessible location. Where installed in exposed locations paint boxes to match the adjacent surface.
- D. Provide a label at the fire alarm control panel that identifies the panelboard and circuit number that supplies the control panel. Provide a red label adjacent to the circuit breaker inside the panelboard that clearly identifies the circuit breaker that feeds the control panel in accordance with NFPA requirements.

3.11 CODE REQUIRED MARKINGS AND WARNINGS:

- A. Provide all placards, markings and identification systems required by Code and/or the Contract Documents, such as (but not limited to):
1. Arc Flash.
 2. Conductor insulation color identification.
 3. Special conductor identification and legends.
 4. Multiple services placards.
 5. Emergency systems markings.
 6. Emergency source grounded circuit conductor connected to a grounding electrode at a location remote from the emergency source: Provide a sign at the grounding location identifying all emergency and normal sources connected at that location.
 7. Warning messages shall include an appropriate plain language imperative command, such as "DANGER HIGH VOLTAGE - KEEP OUT".
 8. Available Fault Current: Service equipment shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault calculation was performed and shall be of sufficient durability to withstand the environment involved.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes specific requirements, products, and methods of execution relating to lighting controls, approved for use on this project.
- B. Related Sections
 - 1. 260553 - Identification for Electrical Systems
 - 2. 262726 - Wiring Devices
 - 3. 265000 - Lighting Fixtures

1.2 SUMMARY

- A. Provide a Code Compliant Lighting Control System as indicated on plans and outlined in this section.
- B. Control Devices under this section are shown diagrammatically on the drawings and additional Class 1 and/or Class 2 wiring may be required for a complete system. It shall be the responsibility of the contractor and system vendor to determine the quantity and type of cable/wiring required for the complete and proper operation of the system. System design is based upon a wireless lighting control system.
- C. Provide material, labor and programming to provide a complete and properly working system that complies with listed sequences of operation.
- D. Proper product adjustment, testing, and training shall take place in compliance with this document as well as applicable energy codes and listed sequences of operation.

1.3 SUBMITTALS

- A. Provide Submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.
- B. Shop Drawings/Submittals shall include but not limited to:
 - 1. Layouts of photocells, occupancy sensors and devices necessary for a complete working system.
 - 2. Wiring diagrams showing the connection of all system parts and necessary electrical provisions to accommodate the intent of the design.
 - 3. Installation sheets with complete product information.
 - 4. Manufacturer Start-up Instructions and requirements.
 - 5. Manufacturer's warranty certificate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of controls design Manufacturer Cree Lighting, Inc.; SmartCast® Technology.

- B. Substitutions:
 - 1. No substitutions.

2.2 SYSTEM REQUIREMENTS

- A. Power Failure Recovery: When power is interrupted and subsequently restored, lights to automatically return to same levels (dimmed setting, full on or full off) as prior to power interruption.
- B. Addressing: All wireless luminaires and devices shall be automatically addressed, on a per luminaire or multiple luminaire/zone basis, as part of an automated setup and configuration process.
- C. Programmable Task Tuning: Maximum light level programmability shall be available by space.
- D. Unoccupied State: The system shall provide two states when occupancy status is vacant as per an occupancy sensor - lights turn off or lights adjust to configurable (dimmed) light level.
- E. Occupied State: The system shall provide two states when occupancy status is occupied as per an occupancy sensor - lights remain unchanged at the current level or lights adjust to configurable (dimmed) light level.
- F. Re-configurability: The assignment of individual luminaires to zones shall be configurable by software such that physical rewiring will not be necessary when workspace reconfiguration or re-zoning is performed. Removal of covers, faceplates, ceiling tiles, etc. shall not be required.
- G. The system shall offer occupancy sensing based plug load control capability.
- H. Wireless Devices:
 - 1. Wireless device family includes luminaire integrated sensors, fixture level load controls for dimming, and area sensors and dimming or switching load controls that can be mounted on a junction box or at the fixture.
 - 2. Wireless devices including sensors, load controls and wall stations can be set up using a hand-held programmer without needing any other equipment.
- I. Wireless Network:
 - 1. RF Frequency: 2.4GHz mesh network
 - 2. IEEE 802.15.4 compliant
 - 3. System self-assigns to quietest channel during setup
 - 4. Encryption: AES 128-bit
 - 5. Range: 30' (9.1m) in typical commercial applications. 300' (91.3m) open air without obstructions
 - 6. Network: 250 devices max
 - 7. Space: 100 devices max per group

2.3 LOAD CONTROL MODULES

- A. All wireless load control modules are to be hardwired for power.

- B. 0-10V Interface: Interface to provide wireless control of 0-10V dimming luminaires. Interface consists of a plenum rated wireless interface box, occupancy/vacancy sensor and associated control wiring. Switched output not to exceed 5A/120V or 3A/277V. Sensors to be placed as per local energy code requirements.
 - 1. Basis of Design: Cree SmartCast® Technology, Model: CIF-10V-CWC-SNSR.
- C. Plug Load Controller: Controller provides wireless directly switched control of 20A receptacles and control of other systems through the use of Dry Contact Closure Output. Interface consists of a plenum-rated wireless interface box and occupancy/vacancy sensor and associated control wiring. Not for use with equipment that requires constant power or equipment that presents a hazard if automatically energized. Interface to provide both normally open and normally closed dry contacts Do not connect inductive loads such as relays, solenoids, contactors and motors to contact closure outputs.
 - 1. Basis of Design: Cree SmartCast® Technology, Model: CPLC-JB-CWC.

2.4 WALL CONTROL STATION

- A. All wall control stations are to be hardwired for power. No battery-powered devices are permitted.
- B. Dimmer: Dimming controller provides on/off and raise/lower control.
 - 1. Color: white.
 - 2. Basis of Design: Cree SmartCast® Technology, Model: CWD-CWC-WH.
- C. Switch: Switch controller provides on/off control.
 - 1. Color: white.
 - 2. Basis of Design: Cree SmartCast® Technology, Model: CWS-CWC-WH.
- D. CCT Dimmer: Dimming controller provides on/off and raise/lower control of light intensity. Controller also provides control of luminaire CCT.
 - 1. Color: white.
 - 2. Basis of Design: Cree SmartCast® Technology, Model: CWD-CWC-WH.

2.5 CONFIGURATION TOOL

- A. Provide one (1) handheld wireless configuration tool to be turned over to Owner upon completion of on-site training. Controller to allow the user to address and configure devices and to form groups without the need for central control software.
- B. Basis of Design: Cree SmartCast® Technology, Model: CCT-CWC-1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with the manufacturer's instructions in the locations indicated on the Drawings. Proper judgment must be exercised in executing the installation so as to ensure proper operation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

- B. Locate and aim occupancy sensors as required for complete and proper volumetric coverage within the range of coverage of controlled areas per the manufacturer's recommendations. Rooms shall have 90% minimum coverage to completely cover the controlled area. Coverage shall accommodate all occupancy habits of single or multiple occupants at any location within the room. The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only the minimum quantity and placement of sensors that are to be provided. Provide additional sensors if required to properly and completely cover the respective room. Light fixtures belonging to the same area shall be controlled in unison from a quantity of occupancy sensors as detailed above to provide full coverage of the area, with manual overrides for on/off control and dimming of individual control zones wall mounted as indicated on the drawings.
- C. All occupancy sensors shall be installed in accordance with manufacturer's recommendations. All units shall be set to "automatic on" mode and the maximum time delay before turning off light fixtures. Verify proper operation of all sensors. The sensing units' coverage area shall be restricted if required to avoid sensing people or extraneous influences in adjacent areas or corridors. This shall be done by covering a portion of the sensing lens with white paper tape in accordance with manufacturer's recommendations.
- D. Contractor is to provide a sufficient quantity and layout of occupancy sensors to properly meet coverage and intended sequence of operation. Locations shall be carefully selected to insure that coverage patterns are unobstructed.
- E. Mount occupancy sensors and photocells in finished spaces according to manufacturer instructions. In unfinished spaces or where ceiling-type sensors are installed where there is exposed structure, mount the sensors in surface mounted outlet boxes.
- F. Mount exterior photocells on flush-mounted outlet boxes.
- G. Wiring shall be arranged as shown on the shop drawings. Wiring and cable shall be installed in raceways or cable trays, except low-voltage cables run above accessible ceilings. Raceways shall be grounded to the power system ground.
1. CAT5 cables connect control devices in uninterrupted continuous runs without intermediate splices. Cables shall be free from shorts or ground and shall be tested.
 2. Cables shall be routed so as to maintain a separation of at least 610 mm (24 in) from all heat sources and from ballasts, transformers, dimmers and other sources of electromagnetic interference. Avoid exposed cables in occupied areas or in areas where they might be damaged as a result of normal use of the area. Where two (2) or more cables run in parallel, they shall be bundled with cable ties
 3. Cables run exposed in ceiling cavities shall be supported by means of suitable cable support devices from the building structure. They shall not lie upon the ceiling, nor shall they be supported from the ceiling frame, ceiling suspension wires, conduits, pipes, ductwork or lights. Supports shall be spaced no further apart than 4 feet on center.
 4. Care shall be exercised during cable installation not to damage cable insulation. Damaged cables shall be removed and replaced. Type and spacing of supports shall ensure that cable will not kink or sag.
 5. In each cable that terminates at a ceiling device, provide 305 mm (12 in) of slack cable, neatly coiled, to facilitate future modifications. Terminations shall be made in a neat and workmanlike manner.
 6. Terminate the manufacturer's recommended cable type to the appropriate termination point (RJ45 jack, etc.). Do not use CAT 5 cable for terminating to blocks.

7. Cabling for 0-10V dimming control shall be installed in raceway (1/2" EMT), except where installed above accessible ceiling. Raceway shall be installed orthogonal to room surfaces, and be concealed by structure wherever possible.
8. CAT5 networked control cable shall be run orthogonal to room surfaces, be routed along edges of rooms and concealed by structure wherever possible. Provide identification for control devices (Device ID #'s) per manufacturer instruction.

3.2 ADJUSTMENT, TESTING & DEMONSTRATION

- A. Notify the Owner's Representative and the Commissioning Authority at least two (2) weeks in advance of the date of each test, to allow witnessing of the tests if desired.
- B. The automatic lighting control devices are subject to commissioning. Assist the Commissioning Authority with scheduling and coordinating commissioning activities, developing commissioning test procedures, conducting commissioning tests, preparing commissioning documentation, and developing a training plan in accordance with specific responsibilities as assigned in Section 01 91 00 and Section 26 05 10. Prior to the start of functional performance testing for commissioning purposes, complete all start-up and checkout procedures and verify that the equipment is completely ready to be tested. A knowledgeable electrician in the employ of the Electrical Installer shall be present during functional performance testing for commissioning purposes.
- C. The contractor is to supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for adjustment, testing and demonstration as needed.
- D. Prior to system testing, prepare a list of the devices to be tested, together with the associated location of each device and device identification (bar code number, ID, etc.). Include space to indicate test response for each device.
- E. During adjustment and testing, carefully record all settings and all test results, including expected test results, actual test results, and corrective actions taken. Records shall be submitted to the Architect's Consultant and included in the Operating & Maintenance Manuals. Settings of devices from software is acceptable documentation
- F. Initial Set-up: Verify that wiring is correctly connected to each device. Adjust controls to function as specified under the sequence of operation. Settings shall comply with direction received from the Architect's Consultant and/or sequence of operation. Default to IES light levels if information is not available at time of initial set up.
- G. Program sequences of operation that include time functions to operate at times selected by the Owner's Representative. Information must be available before technician is scheduled for start-up.
- H. Field Testing: Test all system features for proper function. Tests to be performed shall include, but not be limited to, the following:
 1. Verify the sequence of operation for each device.
 2. Verify the setting and accuracy of each timing function in each device.
 3. Verify that each manual override control functions properly.
 4. Verify that occupancy sensors do not remain actuated due to normal conditions (e.g., air movement).
 5. Verify that occupancy sensors are actuated by hand motion within the entire area of coverage.

6. Verify that occupancy sensors actuate when a person enters the area of coverage.
7. Correct any deficiencies discovered as a result of the above testing, and completely retest the work affected by such corrections as part of the required installation and testing.

3.3 ON-SITE TRAINING

- A. After the system has been completed, tested and is operating properly, the manufacturer's representative shall demonstrate by actual usage, the proper operation of each system device and function in the presence of the Owner's Representative. Demonstration shall include repetition of selected field tests, as well as additional adjustment or testing required to demonstrate that the system performs in accordance with the operational description as specified herein and the Owner's operational requirements.
- B. The training shall be conducted after the Operating and Maintenance Manuals for the project are completed and available for use during the training session.
- C. Conduct two (2) hours minimum of training for the Owner's maintenance personnel in the operation and maintenance of the lighting controls and applicable software. Training time shall be extended as necessary to satisfy the Owner's Representative that all pertinent topics have been adequately covered.
- D. Maintain a training sign-in sheet, upon which participants in the training session, including the instructors, shall record their names. The training sign-in sheet shall be dated.
- E. On-site training shall follow a written training plan, prepared in advance. The training plan shall outline the topics to be covered, the publications to be used, and the training schedule.
- F. The training shall be conducted by technicians who are thoroughly familiar with the equipment and its features, and also with the Project. The training shall include instruction, field demonstration, and over-the-shoulder hands-on exercises. As a minimum, the training shall cover, but not be limited to, the following topics:
 1. General overview of lighting controls, including purpose and principle of operation.
 2. Location of lighting control components.
 3. Interpretation of equipment output devices, such as indicators and status contacts.
 4. Control adjustments and settings.
 5. Operation of system controls, including over-ride switches.
 6. Recommended maintenance procedures and intervals.
 7. Operation of system software.
- G. At the conclusion of the training session, obtain written sign-off from the Commissioning Authority and the Owner's Representative. Insert a copy of the sign-off form and the training sign-in sheet into the Operating and Maintenance Manuals.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes general provisions, products and methods of execution relating to line voltage wiring devices for use on this project.
- B. Related Sections
 - 1. 260533 - Raceway and Boxes for Electrical Systems

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.
- B. Do not place order for devices, plates, etc., without ensuring that the Contracting Agency has positively approved submittals for the specific colors necessary for all applications and locations. Note that the selection of one color for general use does not rule out the selection of other colors for special applications or for aesthetic reasons.

1.4 QUALITY ASSURANCE

- A. Manufacturers mentioned and catalog numbers specified are for establishment of type, configuration and quality. Other manufacturers and types may be submitted for approval.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Catalog numbers shown are Hubbell unless noted otherwise. Equal devices manufactured by Arrow Hart (by Cooper Wiring Devices), Pass and Seymour, Leviton and Bryant are acceptable. Provide all similar devices of same manufacturer.

2.2 SWITCHES

- A. Provide 20 AMP, 277V rated switches with UL listing for tungsten lamp loads or inductive loads without derating. Switches shall be as follows:

	20A Rated Switches
Single Pole	CAT. NO. 1221W
Three-way	CAT. NO. 1223W
Four-way	CAT. NO. 1224W
Double Pole	CAT. NO. 1222W

- B. Multiple 277V switches shall be installed in partition boxes or shall be furnished with shields.
- C. Other switch types shall be provided as called for on the Drawings or as required by the application.

2.3 RECEPTACLES

- A. Provide grounding type receptacles as follows, or as required to match equipment furnished in this or other divisions.

Single Phase, 3-Wire Devices		
15A-125V	CAT. NO. HBL 5262W	NEMA #5-15R
15A-125V GFCI	CAT. NO. HBL GF-15W	NEMA #5-15R
15A-250V Single	CAT. NO. HBL 5661W	NEMA #6-15R
20A-125V USB Charger Tamper Resistant	CAT. NO. HBL USB20A5W	NEMA #5-20R
20A-125V	CAT. NO. HBL 5362	NEMA #5-20R
20A-125V GFCI	CAT. NO. HBL GF-20W	NEMA #5-20R
20A-125V Tamper Resistant	CAT NO. HBL 8300SGWA	NEMA #5-20R

- B. Outlets requiring ratings and configurations different from those listed above shall be provided as shown on the plans and/or required by the equipment served.
- C. Other products may be submitted if they provide equal or better performance to the products specified as the Basis of Design. The substitution request shall include a feature by feature comparison to the specified products or the request will not be reviewed. Substitutions are subject to approval. Samples may be required by the Electrical Engineer for evaluation of performance. Samples will not be returned.

2.4 DEVICE COLOR

- A. Device color shall be white as selected by Architect, unless otherwise noted.
- B. Receptacles connected to emergency or standby power shall be red.

2.5 DEVICE PLATES

- A. Device plates shall be satin finished Type 302 stainless steel, unless otherwise noted.
- B. Weatherproof outlet plates shall be of the safety outlet enclosure type that can be closed to remain weatherproof while in use. The outlet cover/enclosure shall be clearly marked "Suitable for Wet Locations While In Use" and "UL Listed". A gasket shall be provided between the enclosure and the mounting surface, and between the hinged cover and the mounting plate/base to ensure a proper seal. Enclosure shall be oversized depth, single-gang, vertical-mount, with non-locking latch, GFCI opening, cord openings, and cover; TayMac; Specification Grade or approved equal.
- C. Label receptacle and light switch plates in accordance with Section 260553 – Identification for Electrical Systems.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices indicated complete with cover plates. Cover plates shall fit snugly against finished surfaces and line up true with adjacent building lines, and be symmetrical in location and appearance.
- B. Switches shall be installed so their handles move in a vertical plane.
- C. Door swings shall be checked and, if necessary, switches shall be relocated to place them on the strike side of the door.
- D. Unless otherwise noted on the drawings, receptacles shall be installed in the vertical position with the grounding pin down unless wording on the face of the device requires other mounting.
- E. Receptacles identified as Ground-Fault Circuit Interrupter (GFCI) type shall be provided as individual GFCI receptacles.
- F. NEMA 5 configuration receptacles located in shops or commercial kitchens whether on single or multiple receptacle circuits shall be rated at least 20 amps.
- G. Receptacles in child care facilities , guest rooms and guest suites shall be tamper resistant in accordance with NEC Article 406.
- H. Receptacles in pediatric locations shall be tamper resistant in accordance with NEC Article 517.
- I. Occupancy sensors shall be installed in accordance with manufacturer's recommendations. Verify proper operation of sensors. The sensing units' coverage area shall be restricted if required to avoid sensing people or extraneous influences in adjacent areas or corridors. This shall be done by covering a portion of the sensing lens with white paper tape in accordance with manufacturer's recommendations.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Thermal Magnetic Molded Case Circuit Breakers.
 2. Electronic Trip Molded Case Circuit Breakers.
 3. Fusible switches and fuses.

1.2 REFERENCES

- A. The circuit breaker(s) referenced herein shall be designed and manufactured according to the latest revision of the following standards.
1. ANSI/NFPA 70 - National Electrical Code (NEC).
 2. NEMA AB 1 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches.
 3. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures.
 4. UL 943 - Standard for Ground Fault Circuit Interrupters.
 5. UL 1053 – Ground Fault Sensing and Relaying Equipment.
 6. CSA C22.2 No. 5 - (Canadian Standard Association) Molded Case Circuit Breakers, Molded Case Switches and Circuit Breaker Enclosures.
 7. Federal Specification W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
 8. Federal Specification W-C-865 - Fusible Switches.
 9. IEC 60947 – Low Voltage Switchgear and Control Gear – Part 2: Circuit Breakers.
 10. IEC 61000-4 Series – Electromagnetic Compatibility.

1.3 SYSTEM DESCRIPTION

- A. Provide overcurrent protective devices as specified herein and as shown on schedules and/or drawings.

1.4 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Submit product data for each type of overcurrent protective device, ground fault protector, accessory, and component indicated. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- C. Provide outline drawings with dimensions, and ratings for voltage, amperage and maximum interruption. Include instructions for circuit breaker mounting, trip unit functions and adjustments, trouble shooting, accessories and wiring diagrams.

- D. Coordination data to check protective devices: Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and I_p & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.
- E. Provide information required to verify compliance with the short circuit withstand and interrupting ratings, as shown on the Drawings or further stated in these Specifications.
- F. Arc Flash Hazard Analysis Study: Provide an Arc Flash Hazard Analysis Study for the revised electrical distribution system provided under this project per the requirements set forth in NFPA 70E-Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

1.5 QUALITY ASSURANCE

- A. Devices shall be the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with applicable standards and UL listings.
- B. Nationally Recognized Testing Laboratory (NRTL) Labeling: Electrical equipment and conductors installed in the State of Alaska must be “Approved,” “Certified,” “Identified,” or “Listed” and “Labeled” to establish that the electrical equipment is safe, free of electrical shock and fire hazard, and suitable for the purpose for which it is intended to be used. The manufacturer shall have the specific authorization of one of the Occupational Safety and Health Administration (OSHA) approved Nationally Recognized Testing Laboratories (NRTLs) in accordance with the applicable national standards to label the equipment as suitable.
- C. The overcurrent protection device manufacturing facility shall be Registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9000 Series Standards for quality.

PART 2 - PRODUCTS

2.1 PRODUCT

- A. The Basis of Design is equipment from Square D by Schneider Electric to set a standard for quality. Equipment from Eaton, Seimens Energy & Automation, General Electric, or alternative systems will be considered providing that sufficient documentation is provided to the Contracting Agency that the equipment meets the requirements of the Specifications, and matches the Basis of Design on all points that are pertinent to the Project.

2.2 MOLDED CASE CIRCUIT BREAKERS

- A. General Characteristics:
 - 1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle, and the accessory mounting area.
 - 2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which shall provide quick make, quick break contact action. The circuit breaker shall have common tripping of all poles.

3. The circuit breaker handle shall reside in a tripped position between on and off to provide local trip indication. Circuit breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes (except Type QO/EDB/EGB/EJB).
6. MCCBs shall be able to receive a device for locking in the isolated position. MCCBs that serve as the main service disconnect shall be provided with a device for locking in the isolated position.
7. Electronic components shall withstand temperatures up to 221°F (105°C).
8. Circuit breakers shall be UL listed to accept field installable/removable mechanical type lugs (except Type (except Type QO/EDB/EGB/EJB/QB/QD/QG/QJ).
9. Lugs shall be UL listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 75°C rated wire or 90 C rated wire, sized according to the 167°F (75°C) temperature rating in the NEC.
10. Circuit breakers installed in existing panelboards shall be listed for use for the panelboard model.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings. Install circuit breakers in accordance with manufacturer's instructions, the National Electrical Code and applicable local codes.
- B. Size devices as shown and specified, or as required by the load being served.

3.2 FIELD QUALITY CONTROL

- A. Document each installation and operational step utilizing the approved PC/FT checklists in accordance with Section 019100 - Commissioning.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes general requirements, products and methods of execution relating to lighting fixtures, LEDs, LED drivers and related products approved for use on this project.
- B. The Fixture Schedule is a general guide to type, quality and other characteristics. Fixtures of equal or better performance and quality may be substituted, subject to approval.

1.2 RELATED SECTIONS

- A. 262726 - Wiring Devices
- B. 260943 - Network Lighting Controls

1.3 QUALITY ASSURANCE

- A. The fixture shall be a standard catalog item as described on the Drawings and as made by a nationally recognized manufacturer.

1.4 SUBMITTALS

- A. Provide submittals for all products in accordance with Section 260000 and Division 1.
- B. Fixture mounting shall be clearly identified on submittal information and coordinated with architectural, features, assemblies, details and reflected ceiling plan.
- C. Fixtures and hardware color selection shall be clearly identified on submittal information and coordinated with architectural.

1.5 SHOP DRAWINGS

- A. Provide fabrication drawings that indicate fixture, type, kind, weight, lamp, LEDs, LED drivers, method of fitting and fastening parts together, location and number of sockets, and complete details of method of fitting suspension and fastening fixtures in place. Verify fixture dimensions with construction conditions prior to ordering fixtures.
- B. Provide wiring diagrams that indicate supply power and interconnections for lighting controls, equipment and light fixtures. Provide sufficient information to assemble and install equipment at the project site without further instructions.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Interior lighting fixtures: 36 months from date of Substantial Completion.
 - 2. Controls mounted on or integral to lighting fixtures: 60 months from date of Substantial Completion.
 - 3. LEDs and LED Drivers: 60 months from date of Substantial Completion.

4. Emergency Battery Drivers: 60 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide fixtures in conformance with the Fixture Schedule, with all required flanges and supports. Lighting fixtures shall be provided complete with all suspension, trim, mounting, and operating accessories normally considered necessary for a complete, functional, and safe installation, whether specifically called for in the Contract Documents or not.

2.2 LIGHT EMITTING DIODE (LED) FIXTURES

- A. LED fixtures shall comply with Illuminating Engineering Society (IES) LM-79 guidelines.
- B. LEDs shall comply with Illuminating Engineering Society (IES) LM-80 guidelines.
- C. Fixture shall have an LM-79 photometric test report from a DOE CALiPER NVLAP accredited laboratory.
- D. Fixture shall utilize components (i.e. LEDs, driver, fixture housing, etc) included in LM-79 test.
- E. Fixture shall have lumen maintenance testing with minimum test duration of 10,000 hours.
- F. Manufacturer stated end of life shall be at 70% light output. Operating life shall be no less than 50,000 hours.
- G. Color temperature, and color rendering index (CRI) shall conform to the lighting fixture schedule shown on the Drawings.
- H. Fixture components shall be lead free, mercury free and RoHS compliant.

2.3 FULLY RECESSED FIXTURES

- A. Fixtures shall have thermal protection conforming to NEC and shall so be identified as thermally protected unless fixture is:
 1. Identified for use and installed in poured concrete, or
 2. Identified as suitable for installation in cavities where the thermal insulation will be in direct contact with the fixture.

2.4 DRIVER DISCONNECTING MEANS

- A. In indoor locations, LED Driver(s) shall have a disconnecting means either internal or external to each luminaire to disconnect simultaneously from the source of supply all conductors of the driver and LEDs/LED boards, including the grounded conductor in accordance with National Electrical Code (NEC) Article 410.

2.5 LED DRIVERS

- A. Characteristics:
 1. Input: 120-277V (UL) AC, 50-60Hz

2. Efficiency: >81% at full load
3. Power Factor: >0.9 at full load
4. Total Harmonic Distortion (THD): <20% at full load
5. 0-10V compatibility
6. Flicker-free dimming down to 1%

2.6 EMERGENCY LIGHTING DRIVER – LED

- A. Provide emergency battery driver for LED fixtures with the following features:
 1. Shall be capable of operating at the minimum lumen output specified on the Lighting Fixture Schedule for a minimum of 90 minutes
 2. Universal input (120-277 VAC)
 3. Compatible with the LED fixture and driver intended for use with.
 4. High-temperature long-life, nickel cadmium battery. Electronic charger with 24 hour or less recharge time.
 5. Charge indicator lamp and test switch, with lamp visible, and test switch accessible, without opening fixture.
 6. UL listed.
 7. When used with dimmable drivers/fixtures circuitry/programming to restore light output to specified lumens in emergency mode shall be provided.

2.7 FIXTURE ACCESSORIES

- A. Lenses for recessed fixtures shall be 100 percent virgin acrylic with a minimum overall thickness of 0.125 inches, except where specifically noted.
- B. Canopies for pendant hung fixtures shall be of the ball joint type. Where more than one pendant is used per fixture, a ball joint fitting shall also be provided in the fixture end of each pendant.
- C. Furnish one tamperproof screwdriver of each type of tamperproof fixture as required by fixtures specified on this project.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drivers shall be installed per manufacturer's recommendations.
- B. Fixtures with integral drivers shall have the driver installed and prewired at the factory.
- C. Internal fixture wiring shall be factory installed in multiple fixtures which share a common driver. All wiring harnesses shall include an integral copper grounding conductor.

3.2 INSTALLATION

- A. Install fixtures level, plumb and true. Align rows accurately in three dimensions.
- B. Support suspended acoustical ceiling fixtures according to the requirements of the IBC and Section 260529 – Hangers and Supports and Section 200548 – Mechanical Vibration and Seismic Control as well as any local amendments.

- C. Fixture pendants, canopies, blank sections, corners, tees and other such accessories shall be finished to match their respective fixture.
- D. Refer to applicable details on architectural drawings for specific mounting requirements for all fixtures with special mounting requirements such as cove-mounted fixtures and linear fixtures.
- E. For linear fixture systems, verify fixture dimensions and mounting type with other trades prior to installation.
- F. Utility Rooms: Surface ceiling mount fixtures in rooms/areas with ceilings. In areas without ceilings pendant fixtures down to bottom of structure or height indicated on the Lighting Fixture Schedule. In areas with mechanical equipment, ductwork and piping, pendant fixtures down to bottom of mechanical ductwork or piping as appropriate. Fixture pendants shall be rigid (threaded hangar rods) and shall be sway braced where pendants exceed 24 inches in length.
- G. Provide an unswitched circuit connection for the following (as applicable):
 - 1. Exit signs
 - 2. Emergency lighting units (ELUs)
 - 3. Emergency fixtures
 - 4. Emergency night lights
 - 5. Fixtures with emergency battery LED drivers
- H. Wiring for fixtures connected to emergency circuits shall be kept entirely independent of all other wiring and equipment in accordance with NEC Article 700.
- I. Clean all fixtures and lenses prior to final acceptance.

3.3 FIRE-RESISTIVE CONSTRUCTION

- A. Refer to Section 260000 Electrical General Requirements.

3.4 FIELD QUALITY CONTROL

- A. Document each installation and operational step utilizing the approved PC/FT checklists in accordance with Section 019100 - Commissioning.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION AND GENERAL SPECIFICATIONS

- A. Provide the equipment, materials, and labor to install the systems shown on the Drawings and specified herein. This shall include (but not be limited to) provision of all trenching and backfill, raceways, sleeves, boxes, gutters, shelves, enclosures, shelf and enclosure supports, backboards, equipment racks, line and low voltage wire and cable, pull ropes (in unused conduits), terminal modules, panels, outlets, jacks, splices, connections, cable management, labeling, testing and all other material, equipment, and labor required to make the systems fully operational.
- B. The intent of this Specification is to place in working order a complete, fully tested and documented Category 6A system complying with the Codes and Standards referenced herein.

1.2 RELATED SECTIONS

- A. 260533 - Raceway and Boxes for Electrical Systems

1.3 COORDINATION

- A. The necessity to coordinate this work with the Serving Utility, Owner and the Contracting Agency is emphasized.
- B. Coordinate work with other contractors and trades. The layout and installation of the systems shown on the Drawings and specified herein shall be coordinated such that all special requirements for telecommunications systems shall be provided and incorporated into the project. The systems to be coordinated shall include (but are not limited to) electrical raceway, grounding, fire rated assembly, lighting, power distribution, control and instrumentation, and labeling of cables, terminations, outlets, jacks, etc. Report all conflicts to the Contracting Agency.

1.4 CODES AND STANDARDS

- A. Where a Nationally Recognized Testing Laboratory (NRTL) listing or classification exists for a product and the product is suitable for the purpose specified and indicated, the product shall bear the appropriate marking indicating the listing or classification.
- B. Where a UL Standard is in effect, equipment shall:
 - 1. Meet that Standard.
 - 2. Bear the UL Label.

1.5 SUBMITTALS

- A. The following shall be submitted in accordance with Section 260000 - Electrical General Requirements and Division 1 in sufficient detail to show full compliance with the specification:
 - 1. Manufacturer's Catalog Data shall be submitted for the following items. Data shall include a complete list of parts, special tools, and supplies.
 - a. Copper Cable.

- b. Information Outlets.
- c. Patch Panels.
- d. Equipment Racks.
- e. Terminal Modules.
- f. Other accessories.
- 2. Manufacturer’s Installations Instructions.
- 3. Labeling System: Coordinate with Contracting Agency for Owner’s labeling conventions. Submit Project labeling system for approval.
- 4. Contractor qualifications and experience as specified in this Section.
- 5. Manufacturer’s Warranty as specified elsewhere in this Section, including all warranty provisions and procedures for Owner to follow to obtain warranty service.

B. One copy of approved submittals shall be kept at the job site.

1.6 REFERENCE CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only, latest edition. The reference codes and standards are minimum requirements.

Reference	Title/Revision
ANSI/ICEA	Publication S-80-576
ANSI/IEEE C2	National Electrical Safety Code
ANSI/NFPA 70	National Electrical Code
ANSI/T1E1.7/92-004R	Electrical Protection Applied to Telecommunications Network Plant at Entrances to Customer Structures or Buildings
ANSI/TIA/EIA-568-C.0	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA/EIA-568-C.1	Commercial Building Telecommunications Cabling Standard
ANSI/TIA/EIA-568-C.2	Balanced Twisted-Pair Telecommunication Cabling and Components Standard
ANSI/TIA/EIA-569-B	Commercial Building Standards for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-606-A	Administration Standard for Commercial Telecommunications Infrastructure
ANSI/TIA/EIA-607-B	Commercial Building Grounding and Bonding Requirements for Telecommunications
BICSI	Telecommunications Distribution Methods Manual
CFR 47 Part 68	Connection of Terminal Equipment to the Telephone Network
FCC Part 15	Radio Frequency Devices
FCC Part 68	Connection of Terminal Equipment to the Telephone Network
IEEE	LAN Standards: 802.3; 802.4; 802.5; 802.6
UL 1283	Electromagnetic Interference Filters
UL 1449	Transient Voltage Surge Protection
UL 1459	Standard for Telephone Equipment

Reference	Title/Revision
UL 1950	Standard for Information Technology Equipment, Including Electrical Business Equipment
UL 467	Grounding and Bonding Equipment
UL 497	Protectors for Paired Conductors for Communication Circuits
UL 497A	Secondary Protectors for Communication Circuits
UL 497B	Protectors for Data Communication and Fire Alarm Circuits
UL 910	Safety Test for Flame-Propagation and Smoke Density Values for Electrical and Optical- Fiber Cables

1.7 OPERATING CONDITIONS

- A. The electronic equipment designed for office environments and Telecommunications Rooms shall be rated for continuous operation under ambient environment conditions of 10 degrees C (50 degrees F), to 30 degrees C (85 degrees F) and 35 to 65 percent relative humidity, non-condensing.

1.8 QUALITY ASSURANCE

- A. Perform all Work in accordance with all regulatory rules and regulations as well as references in this specification.
- B. Perform all Testing in accordance with ANSI/TIA/EIA-568-C specifications and submit all printed reports.

1.9 QUALIFICATIONS

- A. The telecommunications work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. Bidders for telecommunications work described in this Section shall be specialty telecommunications contractors, who may be a division of the Divisions 26, 27 and 28 Subcontractor.
- B. Contractor Certification:
1. This subcontractor shall be a certified installer of the cabling system, pre-qualified by the Manufacturer for the purpose of offering the Extended System Warranty as required in this Section.

1.10 REGULATORY REQUIREMENTS

- A. All Work shall conform to the requirements of NFPA 70 and all local amendments.
- B. All Work shall conform to the requirements of all Federal, State and Local Electrical and Telecommunications Regulations.

1.11 SPECIAL WARRANTY

- A. The warranty shall extend from the date of Substantial Completion to the longer of twenty (20) years or the length of the Extended Warranty offered by the successful manufacturer.

- B. The warranty shall be extended to the Owner via the manufacturer through a single point of contact and shall be fully backed by the manufacturer.
- C. The Extended Product Warranty and System Assurance Warranty for this wiring system shall be provided consisting of the following:
1. Extended Product Warranty - The Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568-C and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of ISO/IEC IS 11801 for links/channels. The warranty shall apply to all passive Telecommunication Distribution System (TDS) components.
 2. System Assurance - The System Assurance shall cover the failure of the wiring system to support any existing application, as well as additional application(s) introduced in the future by recognized standards or user forums that use the ANSI/TIA/EIA 568-C or ISO/IEC IS 11801 component and link/channel specifications for cabling.
 3. All communications system components shall be rated for end-to-end system Category 6A, or greater performance levels on all pair combinations and warranted to support any existing or future applications which are designed to operate over a 500MHz horizontal channel (as defined in ANSI/TIA/EIA 568-C), to include support of the following applications. Performance shall be guaranteed under the Special Warranty at 100 meters (328 feet):
 4. Extended Product Warranty - The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).
 - a. In the event this specialty subcontractor is unable to perform, goes out of business or ceases to exist, the manufacturer shall be responsible for identifying a new contractor to assume the warranty work.
 - b. Manufacturers shall bear full responsibility for the work of their certified installer, including all aspects of the design and installation.
 - c. In the event this specialty subcontractor fails to provide satisfactory warranty support, the manufacturer shall be responsible for taking all necessary remedial steps including finding a new contractor to provide warranty work.
 5. System Certification - Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
- D. Submit a summary of warranty highlighting major features. Clearly disclose all exceptions to the requirements of this document, and specifically indicate any and all provisions that could potentially void the warranty or reduce its benefit to the Owner.
- E. Warranty programs approved as meeting the specified warranty are listed below. Final approval is subject to review and approval of the warranty:
1. Commscope Uniprise Extended Warranty

1.12 MANUFACTURERS' RECOMMENDATIONS

- A. All installation procedures shall be in accordance with the recommendations of the manufacturer of the material being installed.

1.13 TERMINOLOGY

- A. "TDS" shall refer to the Telecommunication Distribution System cabling and hardware infrastructure internal and external to a building or buildings used to transmit voice, video and data, etc.
- B. "Stations" shall refer to individual telephone or computers, or remote peripherals of those systems (e.g., printers, facsimile machines, modems, etc).
- C. "Outlets" shall refer to the group of receptacles or jacks at the location where the stations connect.
- D. "Jacks" or "Ports" shall refer to the individual receptacles where phones, computers, etc. connect.
- E. "Station Cables" shall refer to the horizontal cables connecting patch panels or terminal blocks in the Telecommunications Rooms to the stations.
- F. "Pathways" shall refer to conduits, sleeves, cable-trays, j-hooks, etc., which are employed to route backbone and stations cables between equipment rooms, telecommunications rooms, stations, outlets, etc.
- G. "Backbone Cables", "Riser Cables" or "Tie Cables" shall refer to copper cables 25-pair or more and optical fiber cables 6-strand or more, connecting main cross-connect facilities, intermediate cross-connect facilities and telecommunications rooms. These cables may include outside plant cables between buildings and riser cables between floors.
- H. "Equipment Rooms" (ER) or "Communication Equipment Rooms" (CER) shall refer to a special-purpose room that provides space and maintains a suitable operating environment for large communications and/or computer equipment. Main rooms may also be referred to as an MDF.
- I. "Telecommunications Rooms (TR)" shall refer to a floor-serving facility for housing telecommunications equipment, cable terminations and cross-connect wiring. This is the point at which station cables terminate. It may also be referred to as an IDF.
- J. "Terminal Blocks" shall refer to multiple punch down cable terminations.
- K. "Patch Panels" shall refer to rack or frame mounted multiple punch down cable terminations with RJ-45 style, 8P8C jacks on the face for "plug and play" cross connect capability.
- L. "Cable Management" shall refer to j-hooks, troughs, gutters etc., mounted in conjunction with telecommunications distribution equipment and terminal blocks, for the orderly routing of cables, patch cords, etc.
- M. "LEC" shall refer to the Local Exchange Carrier providing telephone service to the facility.

1.14 STORAGE AND HANDLING

- A. Care shall be exercised in handling materials during construction. Damaged materials shall be repaired or replaced as directed by the Contracting Agency.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials shall be as specified, first quality, manufacturer's current production.
- B. The Basis of Design for copper cabling, connecting hardware, and related hardware in this section is Commscope Uniprise cabling and Commscope Uniprise hardware with the CommScope Uniprise Warranty as standards for quality and performance and to match existing cabling system installed. All manufacturers other than those listed in this section will be rejected without review.
- C. The approved alternate cabling products manufacturers are:
 - 1. Superior Essex
 - 2. Berk-Tek
- D. The approved alternate connecting hardware products manufacturers are:
 - 1. Ortronics
 - 2. Leviton
- E. Products shall provide the standard of performance required under paragraph 1.1 and the Special Warranty above.

2.2 PATCH PANELS

- A. Patch Panels: Modular jack panels shall be in 24 or 48 port configurations as shown on the Drawings. Modular jack panels installations shall contain a retaining trough between every panel. Modular Jack Panels shall be wired for T568A configuration.
- B. The terminations shall have the following characteristics:
 - 1. Wire Size Supported:
 - a. Solid Wire Ranges: 22-26 AWG, Re-termination >200
 - b. Stranded (7 Strands) Wire Ranges: 22-26 AWG, Re-termination: >200
 - 2. Electrical Specifications:
 - a. Meet or exceed performance defined by ANSI/TIA/EIA-568-C.2, for Category 6A component, link and channel performance.
 - b. UL Listed.
- C. Designation labels for each jack shall be provided for front/rear labeling of each patch panel. All cables shall be terminated in numerical sequence and labeled as to outlet number and jack position (A, B, C, D). Provide color-coded inserts ("icons") for all jacks at patch panels and at each outlet.
- D. Equipment:
 - 1. Category 6A: High Density Modular Patch Panels
 - 2. Comply with FCC Part 68.
 - 3. ISO 9001 Certified Manufacturer.

2.3 INFORMATION OUTLETS/JACKS

- A. Faceplate Requirements:
1. Configure single gang outlet information outlets in single, duplex, triplex, quad-plex, or six-plex jack arrangement, as indicated on the Drawings.
 2. Provide outlet faceplates with either top or bottom labeling positions.
 3. Provided blank module inserts for all unused module locations.
 4. Equipment: Refer to Specification Section 262726-Wiring Devices for faceplate type/color.
- B. Jack Requirements:
1. Jacks for Voice and Data:
 - a. Communications jacks shall consist of multi-position 8-pin modular (8P8C) jacks.
 2. Category 6A Jacks:
 - a. Jacks shall be manufactured by the same manufacturer as the modular patch panels.
 - b. All Jacks shall conform to ANSI/TIA/EIA 568-C Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section and shall meet or exceed the following electrical and mechanical specifications:
 - 1). Electrical Specifications: Jacks shall meet or exceed performance specifications for the Channel as defined by ANSI/TIA/EIA-568-C.
 - 2). Temperature Range: -40° to 150°F (-40° to 66°C).
 - 3). Comply with FCC Part 68.
 - 4). ISO 9001 Certified Manufacturer.

2.4 PATCH CORDS

- A. Patch cords and equipment cords will be Owner furnished and Owner installed.

2.5 HORIZONTAL CABLES

- A. General:
1. Data cables shall be extended between the station location and its associated TR and shall consist of 4 pair, 23 gauge, UTP, and shall be terminated on the 8 pin modular jacks provided at each outlet. Cable jacket shall comply with Article 800 NEC for use as a plenum cable. The 4 pair UTP cable shall be UL Listed Type CMP (plenum).
 2. Where conduit is run below slab-on-grade, the cable jacket shall be wet location rated.
 3. Provide cables with four FEP insulated conductor pairs (4/0 configuration)
 4. Category 6A UTP, 4 Pair .
 5. All cables shall conform to the ANSI/TIA/EIA 568-C Commercial Building Telecommunications Cabling Standard, Horizontal Cable Section, and be part of the UL LAN Certification and Follow-up Program.
 6. Cables shall meet or exceed Category 6A performance specifications for the Channel as defined by ANSI/TIA/EIA-568-C.2.
 7. Environmental:
 - a. Storage temperature: 68° F to 122° F (20° C to 50° C).
 - b. Installation Temperature: 32° F to 122° F (0° C to 50° C).
 - c. Operating Temperature: 14° F to 140° F (-10° C to 60°).
 8. UL or ETL Verified for Category 6A Electrical Performance.
 9. UL Listed for Fire Safety.
 10. ISO 9001 Certified Manufacturer.

11. Equipment: Category 6A, Uniprise Ultra 10, or as approved.

2.6 LABELING

- A. Provide machine printed labels for all patch panels, cables, outlets, etc., in accordance with ANSI/TIA/EIA-606-B. Provide labeling nomenclature in accordance with information on the Drawings or Owner's labeling conventions. Submit labeling samples for all required applications.
- B. Labeling and color coding identification for this project shall conform to TIA/EIA-606-B for a Class 3 Administrative System.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide, connect and test all equipment and materials for the systems herein specified and shown on the Drawings. All wiring shall be neatly tied or laced in cabinets and terminated on terminal strips provided for the purpose. Each cable shall be identified by an approved marking system at each end.
- B. Outlet/Jacks shall be identified with machine printed labels. Hand lettered labels shall not be used.
- C. Provide labels and color-coded inserts for each jack at patch panels, in accordance with TIA/EIA-606-B.
- D. Provide full set of snap-in icons for workstation outlets for use by Owner to mark jacks for analog and digital telephones as two unique classes of data. Store icons in clear plastic bags in each MTR/TR.
- E. Coordinate installation of lighting, ventilation and all other systems in the communication rooms to avoid interferences.
- F. Test the systems and provide training as specified.
- G. Work under this section shall be closely coordinated with work under other sections of the project.

3.2 COLOR CODE SYSTEM

- A. Cables for one floor may be run in the tray system of another floor where necessary or shown, and shall be clearly identified by their unique floor-specific color. One color shall be used for all horizontal cables originating on a floor. A different color shall be used for the floor above, and another unique color for the floor below.

3.3 CODES AND PERMITS

- A. Apply and pay for all fees, permits, and obtain serving utility and governmental approvals.
- B. Coordinate all work with the serving utility.

- C. Raceway fill requirements for communications systems shall be in accordance with ANSI/TIA/EIA-569 and BICSI.
- D. NEC bending radius of all communications ducts, raceways, cable trays, etc., shall be increased to not less than the installed cable manufacturer's recommendations, and the applicable ANSI and BICSI Standards.
- E. Communications work shall be in complete accordance with the following:
 - 1. National Electrical Code (NEC), latest legally enacted edition.
 - 2. Regulations of the State Fire Marshal.
 - 3. National Fire Protection Association (NFPA) Codes.
 - 4. All state, county and local codes and ordinances.

3.4 DELIVERY AND STORAGE

- A. Materials and Equipment shall be stored with protection from mechanical damage, weather, humidity and temperature variation, dirt and dust, and other contaminants.
- B. Cables shall be tested immediately upon receipt and received or rejected and returned based upon testing or visual inspection.

3.5 LAYOUT

- A. All work shall be laid out in advance. Shop drawings shall be submitted to the Contracting Agency for approval before work begins. Maximum height for terminal blocks and patch panels shall be 6 feet-6 inches, minimum height shall be 1 feet-6 inches. Cables shall be racked and supported in a workmanlike fashion. All work shall be labeled according to ANSI/TIA/EIA 606-B, and color coded according to BICSI Standards. In the absence of details on the drawing governing the layout of terminations, the following guidelines shall apply.
 - 1. All horizontal cables from a common outlet shall terminate sequentially (in groups) on the same patch panel.
 - 2. Trunk or riser cables shall terminate on dedicated terminal blocks, separate from but adjacent to horizontal terminal blocks.
- B. Keep up to date "As-built" record drawings at each job site detailing the layout of all data racks and telephone, data and trunk terminations, including a typed listing of cables/rooms served by each terminal block and patch panel. Refer to Section 260000 - Electrical General Requirements for other Record Document requirements.
- C. Layout Shop Drawings shall be prepared using CAD. Final approved Shop Drawings shall be updated with precise "as-built" conditions and shall be submitted with the Operations and Maintenance Manuals. File format shall be AutoCAD "DWG" or "DXF."

3.6 CABLE INSTALLATION

- A. If cable dimensions shown are exceeded, all cable pathways and supports shall be resized to maintain the original fill ratios based on the dimensions shown.
- B. Follow cable manufacturer's specification regarding handling methods, retaining/support methods, bending radius and maximum pulling tension limitations.

- C. Telecommunication cables shall not be installed in the same raceway as power cables.
- D. All cables shall be routed to minimize EMI and RFI interference. All cable shall be routed according to the following table. Spacings are minimum for all Category 3 and higher cable.

Minimum Separation of Telecommunications pathways from 480 volt or less power lines			
Condition	<2 kVA	2-5 kVA	>5 kVA
Unshielded power lines or electrical equipment in proximity to telecommunications open or nonmetal pathways.	5 in	12 in	24 in
Unshielded power lines or electrical equipment in proximity to telecommunications grounded metal conduit pathways	2.5 in	6 in	12 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a telecommunications grounded metal conduit pathway	N/A	3 in	6 in
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to telecommunications open or nonmetal pathways.	2.5 in	6 in	12 in
Mechanical ductwork, metal floors and other metallic planes to telecommunications open or nonmetal pathways.	2 in		
Mechanical ductwork, metal floors and other metallic planes to telecommunications open or grounded metal conduit pathways.	0 in		

3.7 LUBRICANT

- A. Pulling lubricant, shall be used to minimize pulling tension and prevent sheath damage when pulling cables into ducts and conduits. Lubricant shall be applied to the cable sheath with a lubricator. When pulling has been completed, the exposed cable ends shall be wiped clean of lubricant.
- B. Lubricants shall be compatible with and intended for use with plastic-sheathed cables. Soap and grease type lubricants shall not be allowed.

3.8 DAMAGE AND DEFECTS

- A. Use a tension monitoring device to ensure that the maximum pulling tension that may be applied to the cable to be pulled into a conduit section is not exceeded.
- B. Cable shall be carefully inspected for sheath defects or other irregularities as it is paid out from the reel.

- C. Adequate care shall be exercised when handling and storing reels of cable to prevent damage to the cable. Cable with dents, flat spots, or other sheath distortions shall not be installed.

3.9 CABLE SUPPORTS

- A. Mount distribution rings (J-hooks) on appropriate mounting hardware suitable for the specific application. Mount securely to the building structure. Maximum support spacing shall be 4 feet on center.
- B. Coordinate the layout of cableways with all other trades. Report conflicts to Contracting Agency for resolution by the Contracting Agency.

3.10 TERMINATIONS

- A. Cables shall be marked with wire markers at both ends, and terminals on terminal blocks or patch panels shall bear the cable number. Trunk cables shall be neatly marked with "From-To" information.
- B. Wire twist shall be maintained to within 0.25 inch of the termination.

3.11 TERMINATION MODULES

- A. Protection modules shall conform to NEC 800-30 and be installed per manufacturer's recommendations.

3.12 COMPLETION AND TESTING

- A. Telecommunications System test reports shall be submitted to and approved by the Contracting Agency. The test reports shall certify that the Telecommunications Distribution System is complete, passes all test criteria, is fully operational, and that all work has been witnessed as specified.
- B. Incoming Inspection Tests:
 - 1. Inspect all materials for damage.
- C. Final Inspection Tests:
 - 1. Testing of all copper wiring shall be performed prior to system acceptance. 100 percent of the horizontal and riser wiring pairs shall be tested. Link testing of all copper cabling shall be performed. Complete, end to end test results shall be submitted to the Contracting Agency.
 - a. Category 6A cable runs shall be tested for conformance to the specifications of EIA/TIA 568-C.2, Category 6A. Testing shall be done with a ANSI/TIA/EIA 568-C ETL verified Level II-E test set, with accuracy per Proposed TIA Level III standards.

3.13 OPERATING AND MAINTENANCE MANUALS

- A. Prepare manuals describing the servicing and maintenance requirements for the equipment being provided as required in this Section of these specifications.
- B. Refer to "Submittals" requirements of this Section for additional O&M requirements.

3.14 INSTRUCTION AND TRAINING

- A. Provide detailed instructions to the Owner on how to obtain warranty service under the Special Warranty.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification covers the requirements for the materials, installation, programming and re-configuration of the existing Addressable Fire Alarm System.
- B. Fire alarm modifications for this project is limited to the relocation of devices and re-acceptance testing. This product specification is provided in the event that existing devices are not suitable for reuse or additional devices will be required by MOA review or existing field conditions.
- C. Furnish labor, equipment and materials to provide a complete addressable fire alarm system. System shall include initiating devices, notification appliances, control devices and monitoring as indicated on the drawings and as specified herein.

1.2 REFERENCES

- A. The equipment and installation shall comply with the current provisions of the following Codes and Standards:
 - 1. National Electric Code, Article 760.
 - 2. National Fire Protection Association Standards:
 - NFPA 72 National Fire Alarm Code
 - NFPA 101 Life Safety Code
 - 3. Local and State Building Codes.
 - 4. Local Authorities Having Jurisdiction.
 - 5. ULC, CSFM, BSA
 - 6. Underwriters Laboratories Inc.
- B. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:

UL 864/UOJZ, APOU	Control Units for Fire Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems.
UL 268A	Smoke Detectors for Duct Applications.
UL 217	Smoke Detectors Single Station.
UL 521	Heat Detectors for Fire Protective Signaling Systems.
UL 228	Door Holders for Fire Protective Signaling Systems.
UL 464	Audible Signaling Appliances.
UL 1638	Visual Signaling Appliances.
UL 38	Manually Activated Signaling Boxes.
UL 346	Waterflow Indicators for Fire Protective Signaling Systems.
UL 1971	Standard for Signaling Devices for the Hearing Impaired.
UL 1481	Power Supplies for Fire Protective Signaling Systems.

- C. Americans with Disabilities Act (ADA).
- D. International Standards Organization (ISO).
 - 1. ISO-9000.
 - 2. ISO-9001.

1.3 SUBMITTALS

- A. Provide submittals for products in accordance with Section 260000 - Electrical General Requirements and Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

1.5 WARRANTY AND SERVICE

- A. Warrant all components, parts and assemblies against defects in materials and workmanship for a period of 12 months from date of final completion. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully-staffed branch office located within a reasonable distance from the job site.
- B. Service availability: The supplier shall have sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 2 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The existing building fire alarm system is the Simplex (4100ES).
- B. Equipment furnished for this project shall be new. Components and systems shall be designed for uninterrupted duty. Equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use.
- C. Equipment provided shall be of a single manufacturer to insure absolute compatibility between the appliances and the control panel(s), and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.
- D. If any equipment or device connected to the fire alarm system is provided by a different manufacturer, then that equipment shall be recognized as compatible by both manufacturers, and listed as such by Underwriters Laboratories.

2.2 ADDRESSABLE DETECTORS

- A. General:
 - 1. Each addressable detector shall include a sensor base containing a microprocessor control unit for scanning the sensor, analyzing the sensor output and communicating the sensor status to the FACP and a separate sensor containing the actual sensing instrumentation.

2. The sensor connects to the sensor base with a twist-locking plug connection. No special tools shall be required to remove sensor from the base once it has been installed. Removal of the sensor from the base shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
3. The control unit shall scan each sensor for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor, but shall indicate a "Wrong Device" trouble condition.
4. The sensor's electronics shall be immune from nuisance alarms caused by electromagnetic and radio frequency interference.
5. Detectors shall not require resetting or readjustment after actuation to restore normal operation.
6. Removal of the sensor head for cleaning shall not require the setting of addresses or remapping of the device.
7. Detector assemblies shall be suitable for operation in the following environment:
 - a. Temperature: 32°F to 120°F (0°C to 49°C).
 - b. Humidity: 10-95% RH, non-condensing.

B. Sensor Bases

1. Standard Detector Mounting Base:
 - a. Bases shall be listed for ceiling or wall mounting.
 - b. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 - c. Each sensor base shall include a communication transmitter and receiver having a unique identification and capability for status reporting to the FACP. Device address shall be located in sensor base to eliminate false addressing when replacing sensors.
 - d. Simplex 4098-9792 Standard Sensor Base
2. Detector Mounting Base with Unsupervised Wired Connection:
 - a. Mounting bases with unsupervised wired connection shall have all the features of the standard sensor base and include a connection for a remote LED alarm indicator or unsupervised relay.
 - b. Simplex 4098-9789 Sensor Base with Wired Connection
 - c. With Simplex 4098-9808 Remote LED Alarm Indicator or Simplex 4098-9822 Unsupervised Relay
3. Supervised Relay Mounting Bases:
 - a. Supervised relay mounting bases shall have all the features of the standard sensor base and include a two or four wire connection for supervised relay.
 - b. In addition to supervised relay connection, supervised relay mounting bases shall have a wired connection for Remote LED Alarm Indicator or Unsupervised Relay.
 - c. Simplex 4098-9791 4-Wire Sensor Base with Simplex 2098-9737 Supervised Relay, or
 - d. Simplex 4098-9780 2-Wire Sensor Base with Simplex 4098-9860 Supervised Relay
4. Isolator Bases:
 - a. Isolator Bases shall have all the features of the standard sensor base and shall have short circuit wiring isolation such that the input wiring is isolated from the output wiring when a short circuit occurs.
 - b. Isolator bases shall report back to the FACP when a short circuit is detected.
 - c. Simplex 4098-9793 IDNet Isolator Base.

- C. Sensors:
1. Fixed Temperature/Rate of Rise Heat Detector:
 - a. Fixed temperature/rate of rise heat detectors shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 60 ft (18.3m) spacing on center.
 - b. Simplex 4098-9733 Heat Sensor.
 2. Photoelectric Smoke Detector:
 - a. Photoelectric smoke detectors shall have the ability to set the sensitivity and alarm verification of each individual detector on the circuit. Each smoke detector may be individually programmed to operate at any one of seven (7) sensitivity settings. The detection algorithm shall incorporate intelligent data evaluation to filter out false and nuisance alarms caused by dust, dirt, etc. Detectors shall automatically generate a dirty sensor status and transmit that status to the control panel.
 - b. Simplex 4098-9714 Photoelectric Sensor.
 3. Multi-sensor Detector:
 - a. Multi-sensor detectors shall include photoelectric and fixed temperature/rate of rise sensors within the same device. Sensing characteristics shall be the same as described for each standalone sensor detailed above.
 - b. Simplex 4098-9754 Multi-Sensor

2.3 ADDRESSABLE MODULES

- A. General:
1. Modules shall be capable of monitoring or controlling one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
 2. Addressable Modules shall be capable of mounting in a standard North American single gang box. Modules include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
 3. Modules shall have a diagnostic LED visible on the finished cover plate. The LED shall flash to confirm communication.
 4. Modules shall be suitable for operation in the following environment:
 - a. Temperature: 32°F to 120°F (0°C to 49°C).
 - b. Humidity: 0-93% RH, non-condensing.
- B. Provide module styles and quantities as necessary to meet the design requirements:
1. Individual Addressable Modules (IAM):
 - a. Simplex 4090 Series
 2. Zone Adaptor Modules (ZAM)
 - a. Simplex 4190 Series
 - b. Simplex 2190 Series

2.4 NOTIFICATION APPLIANCES

A. General:

1. Strobe appliances or combination appliances with strobes shall be capable of providing the "Equivalent Facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA(AG)), and shall be UL 1971, and ULC S526 Listed.

B. Strobes:

1. Strobes shall have white housing and shall mount in a standard North American single gang box.
2. Strobes shall provide synchronized flash outputs. It shall be possible to field select strobe output of 15cd, 30cd, 75cd, or 110cd.
3. Ceiling Mount: Simplex 4906 series
4. Wall Mount: Simplex 49VO series
5. Exterior applications: Simplex 49VO series with 49WP series weatherproof box
6. Mounting accessories and wire guard as required for the installation.

C. Horn/Strobes:

1. Horn/strobes shall have white housing and shall mount in a standard North American single gang box.
2. Strobes shall provide synchronized flash outputs. It shall be possible to field select strobe output of 15cd, 30cd, 75cd, or 110cd.
3. Horn shall have an audible output of 84 dBA at 10 ft. when measured in reverberation room per UL-464.
4. Horn audible output shall be in a synchronized temporal pattern.
5. Ceiling Mount: Simplex 4906 series
6. Wall Mount: Simplex 49VO series
7. Exterior applications: Simplex 49VO series with 49WP series weatherproof box
8. Mounting accessories and wire guard as required for the installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturer's manuals and wiring diagrams. Furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the NEC, approved by local authorities having jurisdiction for the purpose.
- B. All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.
- C. All wiring shall be in metal raceways shared by no other system. Raceways shall be installed in accordance with Section 260533 – Raceways and Boxes for Electrical Systems.
- D. Field devices shall be installed in accordance with Section 260533 – Raceways and Boxes for Electrical Systems. Paint boxes and covers red.

- E. Install Conductors in accordance with Section 260519 – Low Voltage Electrical Power Conductors and Cables. All wires shall be landed on device terminals, or terminal strips or blocks, and shall be labeled and numbered at their terminations. All wiring shall be installed in a neat and workmanlike manner. Bundles of wiring shall be secured with self-locking nylon cable ties, not tape.
- F. Coordinate exact mounting locations with the reflected ceiling plans. Coordinate exact mounting heights with architectural elevations.
 - 1. Where field conditions (such as conflicts with other features, obstructions that violate the placement rules of the applicable Fire Code, and the like) make it necessary to relocate detectors from the positions shown on the plans, such relocations shall be made in strict accordance with the applicable Fire Code, and shall be made at no additional cost to the Owner.
 - 2. As far as possible within the rules of the applicable Fire Code, the final placement of exposed detectors shall present a uniform appearance.
- G. Adjust each detector in accordance with manufacturer's recommendations for the specific location and circumstance.
- H. Control relays shall be located within 3 feet of the device or circuit controlled in accordance with NFPA 72.

3.2 FIRE ALARM SYSTEM SEQUENCE OF OPERATION

- A. The system shall identify any off normal condition and log each condition into the system database as an event.
 - 1. The system shall automatically display on the control panel Liquid Crystal Display the first event of the highest priority by type. The priorities and types shall be alarm, supervisory, trouble, and monitor.
 - 2. The system shall have a Queue operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color coded indicator for each type of event; alarm - red, supervisory - yellow, trouble - yellow, monitor - green. When an unseen event exists for a given type, the indicator shall flash. When all events of a given type have been displayed, the indicator shall change from flashing to steady.
 - 3. For each event, the display shall include the current time, the total number of events, the type of event, the time the event occurred.
 - 4. The user shall be able to review each event by simply selecting scrolling keys (up-down) for each event type.
 - 5. New alarm, supervisory, or trouble events shall sound an silenceable audible signal at the control panel.
- B. Operation of any alarm initiating device shall automatically:
 - 1. Update the control/display as described above.
 - 2. Sound all alarm signals throughout the building at the evacuation rate.
 - 3. Turn on all strobe lights throughout the building.
 - 4. Turn on a red alarm zone LED at the fire alarm control panel.
 - 5. Operate the alarm relay contacts to initiate the transmission of an alarm to a central station agency via leased telephone lines.
 - 6. Operate control relay contacts to shut down air supply fans. Shutdowns shall be hardwired from the Fire Alarm System (i.e., not implemented via building automation

controls) and immediate acting, and shall not be overridden by Hand-Off-Auto switches or other controls.

7. Operate control relay contacts to de-energize smoke/fire dampers to close dampers. Dampers shall typically be interlocked with their associated air handler unit so the dampers close whenever the air handler is de-energized.
8. Separate Alarm and trouble conditions shall be transmitted to the Building Automation System (BAS) and Building Security System. Common alarm, common trouble and common sprinkler alarm conditions shall be monitored by the BCS and Security Systems. Provide separate sets of outputs for the BCS and Security Panels.

C. Activation of a sprinkler supervisory initiating device shall:

1. Update the control/display as described above.
2. Turn on a yellow zone LED at the fire alarm control panel.
3. Operate the supervisory relay contacts to initiate the transmission of a supervisory condition to a central station agency via telephone lines.

D. Fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds or disarrangement of system wiring and shorts across alarm bell/strobe wiring shall automatically:

1. Update the control/display as described above.
2. Operate the trouble relay contacts to initiate the transmission of a trouble alarm to a central station agency via telephone lines.

3.3 SUPPORT FOR INSTALLER AND OWNER MAINTENANCE

3.4 DOOR UNLOCKING DEVICES

- A. Any device or system intended to effect the locking/unlocking of emergency exits shall be connected to the building fire alarm system. These exits shall unlock upon receipt of any fire alarm signal.
- B. All emergency exits connected in accordance with the paragraph above shall unlock upon loss of the primary power to the fire alarm system. The secondary power supply shall not be utilized to maintain these doors in locked condition.

3.5 PROTECTION OF FIRE ALARM CONTROL UNITS

- A. Provide automatic smoke detection at the location of each fire alarm control unit(s) including fire alarm control panels, remote power supplies and remote battery supplies.

3.6 TESTING AND REPORTS

- A. Upon completion of the system installation, an Approved representative of the system manufacturer shall conduct a thorough test of the system and all related devices and components of the system, and submit a written report of the findings to the Contracting Agency. For devices, circuits, and equipment installed or modified as part of the project testing shall include, at the least, verification of the following:
 1. The functional operation of each resettable initiating device (manual fire alarm boxes, detectors, etc.) and circuits.
 2. The functional operation of each and every alarm device and circuit.
 3. The functional operation of each monitored device circuit.

4. The functional operation of each control and output circuit.
5. The supervision function of each Initiating, Indicating, Monitoring, Control and Supply Circuit.
6. Central Station automatic signaling.
7. Proper initiation and execution of mechanical systems control sequences.
8. Verify that wire size, power supply, number of devices on a circuit, etc. are suitable to support 100% of devices being in alarm or operated simultaneously. Test shall include the following as a minimum:
 - a. Place all detectors and monitor modules in alarm. Each shall display its address and alarm condition. At least the first ten devices on each circuit shall also have their alarm LEDs lighted, where applicable.
 - b. Operate all control modules for the alarm or operated condition. Each module shall display its address and condition.
 - c. Reset all alarmed and operated devices. The panel shall display the address of any off-normal devices.
9. Test a representative number of detectors for alarm verification by momentarily testing for alarm. The detectors shall not initiate an alarm. Then test by placing the detectors in alarm such that it remains in alarm for the selected verification time. The detector shall initiate an alarm.
10. Test a representative number of detector for trouble by removing the detector from its base. The address and trouble condition for each shall be displayed. Insert a different type of detector into the base. The address and trouble condition shall be displayed. The detector shall return to normal only when the proper detector type is reinserted into the base.
11. Print out the English-language descriptor, currently sensed value, prealarm threshold value, alarm threshold value and status of each sensor in the system. Also print out the English-language descriptor and status of each module in the system. The printout shall also include the date and time.

3.7 TRAINING

- A. After the system provided in this Section is completely installed and operational, and at a time chosen by the Owner, provide the Owner's system operators and maintenance personnel and representatives of the local Fire Department with a total of four (4) hours of instruction on the operation, maintenance, and troubleshooting of all equipment provided under this Section.
- B. Training sessions shall be presented by a fully qualified, trained representative of the equipment manufacturer, who is thoroughly knowledgeable on the specific installation. Separate sessions shall be given for operation personnel (i.e.: facility staff and Fire Department) and maintenance personnel, with the length and content of the sessions tailored to the respective groups.
- C. Provide an additional one (1) hour of follow-up instruction for review and clarification at a later time mutually agreed on with the Owner, if the Owner deems it necessary.

END OF SECTION